



UGANDA PROTECTORATE

ANNUAL REPORT

OF THE

DEPARTMENT OF
AGRICULTURE

REPORT ON EXPERIMENTAL WORK

FOR THE PERIOD

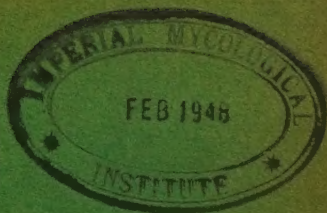
1st July, 1945—31st March, 1946

Published by Command of His Excellency the Governor

ENTEBBE

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INTRODUCTION

Annual Reports Parts I and II have previously covered the period 1st July to 30th June each year. It has now been decided that the pre-war method of reporting on administrative work (Part I), for a calendar year, should be reverted to and that the most suitable period for the experimental report (Part II), would be from 1st April to 31st March.

The next Part I Report will cover the year ending 31st December, 1946, (carrying on the record from the report ended 30th June, 1945). The present Part II Report therefore is without a companion Part I.

E. F. MARTIN,
Acting Director of Agriculture.

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SECTION OF PLANT PATHOLOGY

Mr. C. G. Hansford, Senior Plant Pathologist, spent part of his time assisting with administrative work in Head Office and has since retired from the service.

During the period under review, cotton diseases, especially with reference to Wilt and Blackarm, were studied.

Work on the new virus disease of sweet potatoes, described in the previous report, was continued in collaboration with the East African Research Institute, Amani, the Mulungu Experimental Station of the Belgian Congo and Cambridge University.

The advisory service to assist in the solution of problems arising in the Uganda sugar service was maintained.

REPORT OF THE SENIOR ECONOMIC BOTANIST

Robusta Coffee

Selection.—There were very heavy crops on the older coffee plots at Kawanda: the oldest plot of erect ("Robusta") coffee, planted in 1935, yielded at the rate of 1,860 lbs. of clean coffee per acre, and the plot of spreading ("Nganda") coffee, also planted in 1935, yielded at the rate of 2,380 lbs. per acre. Individual tree records, as fresh cherry, have been kept on these plots since they came into bearing and show the difference in fruiting capacity of the erect and the spreading types:—

Yields of clean coffee in lb. per acre from Kawanda plots of Robusta coffee planted in 1935:—

Season.	Erect.	Spreading.
1937-38 ..	420	150
1938-39 ..	560	220
1939-40 ..	2,100	1,530
1940-41 ..	590	540
1941-42 ..	2,380	1,800
1942-43 ..	1,520	1,300
1943-44 ..	1,200	1,470
1944-45 ..	63	95
1945-46 ..	1,850	2,380

2. Until the plots were 8 years old, the erect types were the most productive, but for the last 3 seasons the spreading types have given the heavier yields. Some spreading trees bore as much as 60 or 70 kg. of cherry, which would correspond to 25 or 30 lbs. of clean coffee, during the last season; and some larger, older, trees on native farms are known to give

even heavier yields. It was expected that the erect types would fruit most heavily at first, but the spreading types are now overtaking them and, for the 7 seasons since the trees came into full bearing, the average annual yields have been 1,390 lbs. and 1,300 lbs. of clean coffee per acre respectively.

3. The younger coffee breeding plots yielded well also; the erect coffee planted in 1937 gave 1,560 lbs. of clean coffee per acre and over the 5 seasons 1941 to 1946 it has given an average of 1,260 lbs. per acre; the spreading coffee, planted in 1937 on a plot of lateritic gravel, gave 1,400 lbs. of clean coffee per acre, making an average of 990 lbs. per acre for the last 5 seasons. The erect Java Robusta coffee selections, planted in 1938 and which had given no crop in the previous season, bore a very heavy crop corresponding to 2,320 lbs. of clean coffee per acre; this coffee has yielded at the average rate of 1,150 lbs. of clean coffee per acre per annum for the last 4 years.

4. *Distribution of Seed.*—The heavy yields of coffee at Kawanda during the season were shown by the amount distributed and sold from about 25 acres, some of which has not yet come into full bearing. 2,035 lbs. of coffee seed was sent out to departmental nurseries; 325 lbs. was sold to estates; and the remainder of the coffee, some in parchment, and some as sun-dried cherry, was sold for over Shs. 10,000. The very heavy crop was followed by intense drought at the beginning of 1946, with the result that there is only a small crop this year; even the young cherry already set on the bushes, which would normally have ripened to give an off season crop, has dried up without development of the beans.

5. *Liquoring Quality.*—Samples of Robusta coffee beans have been submitted several times in the past for trial of their liquoring quality, but usually it has been reported merely that they are readily acceptable on the London market. Samples were collected from 4 outstanding trees; half of each batch was sun-dried in the cherry, and half was pulped, fermented and washed to give parchment coffee. The beans were taken out of each lot and some were sent to the Coffee Division, Ministry of Food, London. It was reported that the liquor of all the beans from sun-dried cherry was "sour"; but that of the washed coffee ranged from "coarse" to "fair, thin". The best flavoured beans were from tree 203/30, the largest in the 1935 block of spreading coffee, whose progeny also is outstanding in the coffee costings plots.

6. *Coffee Costings Plots.*—These plots, planted in 1941, are designed to form a long term experiment and no definite results can be put forward until the coffee is at least 10 years old. The results of the year are summarised in the table below, and the following points may be noted:—

(a) Plots 1, 11 and 12, which have a cover of *Leucaena glauca*, still lag behind the others in growth and in yield. But the coffee bushes are now making good growth and look well in wet weather; yet in dry spells, as in February, 1946, they still suffer badly from drought and the young leaves are dried and blackened.

(b) Plots 2, 3 and 7, which are mulched with elephant grass, have not been so outstanding as they were for the first 4 years. Some of the clean-weeded plots—Nos 8, 9 and 10—gave yields like those of the mulched plots, at a lower cost. Furthermore, the coffee bushes on the clean-weeded plots now look more vigorous and darker in foliage than those on mulched plots. "Clean-weeding" does not mean the rough digging so often carried out in coffee: the weeds are hoed with the least possible

ROBUSTA COFFEE COSTINGS PLOTS AT KAWANDA: EACH PLOT MEASURES 1.03 ACRES.

Plot number and treatment.	Cost of cultivation.	Yield of clean coffee.	Value of coffee.	Value of bananas.	Return 1945-1946.	Total return 1943-1946.
	<i>Shs.</i>	<i>Lbs.</i>	<i>Shs.</i>	<i>Shs.</i>	<i>Shs.</i>	<i>Shs.</i>
1. Spreading coffee. <i>Leucaena glauca</i> cover. No shade ..	110	636	191	..	191	210
2. Spreading coffee. Elephant grass mulch. No shade ..	131	1,600	480	..	480	1,290
3. Erect coffee. Elephant grass mulch. No shade ..	184	1,500	450	..	450	1,460
4. Spreading coffee at 15 ft. x 15 ft. Bananas at 15 ft. x 15 ft. ..	79	552	166	35	201	296
5. Spreading coffee at 20 ft. x 20 ft. Bananas at 10 ft. x 10 ft. ..	80	284	85	32	117	242
6. As in plot 5, but with <i>Ficus</i> shade ..	67	146	44	43	87	200
7. Spreading coffee. Elephant grass mulch, <i>Ficus</i> shade ..	189	1,710	513	..	513	973
8. Spreading coffee. Clean-weeded. <i>Ficus</i> shade ..	60	1,675	502	..	502	868
9. Spreading coffee. Clean-weeded. <i>Albizia stipulata</i> shade ..	68	1,668	500	..	500	707
10. Erect coffee. Clean-weeded. <i>Albizia stipulata</i> shade ..	52	2,035	610	..	610	944
11. Spreading coffee. <i>Leucaena glauca</i> cover. <i>Albizia stipulata</i> shade ..	121	304	91	..	91	94
12. Erect coffee. <i>Leucaena glauca</i> cover. <i>Albizia stipulata</i> shade ..	89	975	292	..	292	311
13. Spreading coffee. Rows of elephant grass. <i>Ficus</i> shade ..	104	978	293	..	293	325

disturbance of the surface mat of coffee roots, and the plots are banded to prevent loss of water or soil.

(c) Plots 4, 5 and 6, in which the coffee is interplanted with bananas, are not banded, but the trash is laid in lines along the contour to control wash. Now that the vigour of the bananas is diminishing, the amount of trash is not sufficient to hold up the water and, although the plots are nearly level, yet there is a considerable run-off of water after heavy storms.

(d) Plot 13, with lines of elephant grass, also shows some run-off at times of heavy rain. When the plot was first planted, the coffee could not compete with the elephant grass and much replanting, continuing into the present year, has been needed to establish a good stand of coffee. The lines of elephant grass have been thinned and now are to be uprooted and replanted in succession. But, as the coffee trees have begun to make vigorous growth, the elephant grass cannot compete with the coffee and the new lines of grass are stunted and gappy so that after heavy rainfall the water runs through them. The average annual rainfall at Kawanda for the 7 years 1939-45 was only 43.88 ins. and, with so small an amount, all run-off must be avoided to prevent loss both of soil and of water, for water supply is a limiting factor to the growth of Robusta coffee here. It was also noted that mealy bug was more abundant at the end of 1945 on the coffee interplanted with *Leucaena glauca* and elephant grass than clean-weeded or mulched plots, a fact which may be correlated with shortage of water.

(e) As individual tree records are kept on these plots and much of the seed is sorted and prepared for distribution, the cost of cultivation does not include that of picking and preparing the coffee. The cost is reckoned at the rate of Sh. 1 per man day.

Arabica Coffee

8. The climate of Kawanda seems better suited to Arabica coffee than to Robusta coffee: for the Arabica coffee did not suffer so much from the drought of January and February and the cherry already set on the trees has ripened to give an off-season crop, as the beans did not collapse like those of the Robusta coffee. When the Kawanda Experiment Station was opened, it was considered to be unsuited to Arabica coffee and it was possible to plant in 1937 only short observation rows of different varieties, 12 plants of each. The plants were spaced at 10 ft. by 10 ft., were not shaded and have not been pruned; they were mulched for 2 years when young and have been given a dressing of ashes this year, but no other manure. The bushes have looked well and have borne good crops of which individual tree records, as fresh cherry, have been kept. These yields have been divided by 5 to give the weight of clean coffee per acre, for it is convenient to make comparisons between varieties on this basis.

Average yields of Arabica Coffee Varieties expressed as clean coffee in lbs. per acre per annum for the years 1941-45.

Mokka	..	..	93	Abyssinian 1	..	..	615
San Ramon	..	..	409	Abyssinian 2	..	..	750
Padang	..	..	692	Maragogipe	..	..	54
Bourbon	..	..	531	Kenya H 3 B	..	..	374
Blue Mountain	..	..	755	Kenya J 2 D	..	..	620
Kent's Arabica	..	..	1,265	Kenya F 2 A	..	..	248
Kenya Series A	..	..	762	Kenya 62	..	..	358
Harar	..	..	3				

It does not follow that the yields from a few bushes is a fair basis on which to assess that of a large area of coffee; and it is even more unwarrantable to multiply the crop of a single bush to give a yield per acre—if that were done, 2 of the Kent's Arabica bushes might be claimed to show a potential production of over 2,000 lbs. of clean coffee per acre per annum.

8. It is obvious, however, that Kent's Arabica, whose yield is nearly double that of the other varieties, is the one best suited to Kawanda conditions; it has also proved to be the best in observation plots in Bugishu and in the Western Province. The Kent's Arabica coffee at Kawanda is now 9 years old and shows no marked diminution of vigour. Some other varieties are failing—the Harar coffee died in 1941; and the Bourbon coffee has repeated its usual performance in Uganda—of giving heavy crops when young and then becoming much less productive. The young plots of Kent's Arabica coffee, planted at the end of 1941, have given the following yields, also expressed in lbs. of clean coffee per acre:—

	1944-45.	1945-46.
1. Coffee 10 ft. × 10 ft., <i>Ficus</i> shade ..	494	634
2. Coffee 15 ft. × 15 ft., among bananas	55	141
3. Coffee 9 ft. × 9 ft., unshaded ..	366	865

There have been many blank places on the plots and the seedlings established in them have not yet come into fruit; the bushes are bearing good crops this year. Unfortunately, the plants have not all come true to type and continued selection will be necessary to give the best possible seed for distribution.

Cinchona

9. Small batches of seedlings from 23 more selected cinchona trees were planted in May on Block 1; they will show how cinchona may grow under Kawanda conditions and they will also show the relative value of the selections as mother trees. The rest of the seedlings were given to the Cinchona Research Organisation. As the study of the crop has been taken over by that organisation, the work which has been carried out in Uganda was summarised in a paper "Cinchona in Uganda" (*Empire Journal of Experimental Agriculture*, April, 1946).

Derris

10. The plot of derris, $2\frac{1}{2}$ acres in size, was dug up when most of the plants were 30 months old and produced 8,226 lbs. of sun-dried roots, both large and small, with a rotenone content of 5.1%. The roots were valued at 17.1 pence per lb. and the gross return was Shs. 11,722. After deduction of charges for transport, commission, etc. the net return was Shs. 9,557 57cts., a very satisfactory figure; for the plot was infested with couch grass (*Digitaria scalarum*) and heavier yields might be expected on clean land. Another smaller plot was planted.

Grasses

11. Notes have been made at intervals on the observation strips of 66 species and varieties of grasses. Many have died back and become very weedy; others were not liked by the cattle. One surprising result was

the excellent growth and persistence of some swamp grasses on the rather poor soil and under the rather dry climate of Kawanda. *Echinochloa pyramidalis* and *Panicum repens* were both growing well two years after planting, and both species were liked by cattle. Some of the most promising local grasses for pastures have been:—

(1) *Brachiaria brizantha* and *Brachiaria decumbens* were liked by cattle and, although they did not give much bulk of herbage, yet remained free from weeds.

(2) *Chloris gayana* was well liked and may be grown easily from seed.

(3) *Cynodon plectostachyum* grew well in dry weather and has remained fairly free from weeds; the palatability of the grass seemed to vary with the variety and with the season.

(4) *Echinochloa pyramidalis* has grown strongly and was palatable.

(5) *Hyparrhenia rufa* has grown strongly, was well liked and has spread into other strips.

Two exotic grasses have been successful:—

(6) *Paspalum dilatatum* gave a dense turf and was much preferred to *Paspalum notatum*.

(7) *Setaria splendida*; a vigorous form grown from seed collected in Nyasaland had a tufted habit but did not become very weedy; it stood drought, and was well liked.

It has been interesting to note how eagerly the cattle ate the stray seedlings of elephant grass on any of the strips; and, as elephant grass grows so rapidly, it seems probable that much more feeding matter per acre could be obtained by growing elephant grass as a fodder crop than from any other species as a pasture at Kawanda.

12. Several more species and varieties were added to the living collection grown in front of the laboratory, and there now remain only a few blank plots. The oldest plots in the collection were planted in September, 1939, and, in some cases, the grasses had lost much of their vigour, were invaded by weeds and were producing few flowers. Therefore the plots were burnt over during the drought in February, and, although there was no rain for a month afterwards, yet only a few species suffered—such as the local *Axonopus compressus* and *Paspalum auriculatum*, which grow in moist places, and the introduced *Paspalum dilatatum*. All the other species seemed to benefit from being burnt, making more vigorous vegetative growth and flowering more abundantly than in former years.

13. The desirability of leguminous pasture plants for mixing with grasses under equatorial conditions has often been mentioned, but few species have proved of much value in Uganda. *Stylosanthes guianensis*, introduced from Australia, has grown well and spread on the museum plots at Kawanda and is worthy of trial on a larger scale.

Botanic Gardens, Entebbe

14. So little time could be devoted to the gardens that it was not possible to make any major developments during the year. The cutting of lawns, sweeping of leaves, repair of roads and drains, and propagation of plants in the nursery absorbed the labour. The lack of good paint for writing labels and the shortage of spare parts for lawn mowers made the upkeep more difficult. But the grass was kept short for most of the time; and the distribution of plants, 7,535 economic and 3,806 decorative, in addition to cuttings and seeds, continued to be an important function of the gardens.

15. *Oil Palms*.—Batches of seedlings from various selected oil palms were planted on the north side of the gardens in the years 1934 to 1936. Records have been kept of the fruit produced by each palm and, as they are now about 10 years old, it is possible to assess their value. Some palms have given as much as 300 lbs. of fruit bunch in one year, but none have given so much on the average; and almost all of the palms have thin flesh and thick shells, so that the proportion of oil in the fruit is low. It seems, therefore, that none of the palms will conform to the standards for selection in other, hotter, countries where the oil palm is important; and there is little prospect of profitable production of palm oil on a large scale in Uganda. As the oil would be a useful addition to native diet, it would be an advantage if the oil palm was grown by Africans for their own use; but it appears that the time and the fuel needed to extract the oil have prevented it from becoming very popular.

A. S. THOMAS,
Senior Economic Botanist.

REPORT OF THE SENIOR CHEMIST

Soil Structure

ANALYTICAL METHODS.

In my last annual report I mentioned the need for further study of sampling and sieving technique before attempting to devise a standard laboratory routine for advisory purposes. In all the earlier work the air dry samples were passed through a 3 mm. sieve, all the larger crumbs being broken down by hand to pass through. In this process many perfectly functional water-stable crumbs are broken down and it is inevitable that a proportion of dust under $\frac{1}{2}$ mm. in diameter is produced in the process. The final crumb percentage obtained is therefore too low. In the 1944-45 season the soil samples were air dried, sieved through the 3 mm. mesh but the proportion that failed to pass through was handled only to find lines of weakness or natural fracture and mixed back. In other words any crumb larger than 3 mm. which could not be broken in gentle handling with the fingers was mixed with the bulk before quartering and weighing samples for the wet sieving process. As might be expected these gave higher crumb structure percentages but the agreement between replicates was poorer. Previous work has shown that a medium loam in good physical condition contains over sixty per cent. of water stable crumbs but only half as many crumbs remain in the same soil after over-cultivation. The range between good and bad therefore is over thirty per cent. so that agreement between duplicates to within five or six per cent. is reasonable. To find out what differences were involved large samples were drawn from the Kawanda Grass randomised block experiment. Each sample was mixed and halved. One half was passed through the 3 mm. sieve normally and in the other the larger crumbs were mixed back as in 1945. The results are shown in Table 1.

TABLE 1.—DIFFERENT METHODS OF TREATMENT OF AIR DRY SOIL BEFORE WET SIEVING.

% WATER-STABLE CRUMBS OVER $\frac{1}{2}$ MM.

				All passing 3 mm.	Large crumbs mixed back.	Increase.
<i>Pennisetum purpureum</i>	..	..		69.0	76.3	7.3
<i>Pennisetum polystachyon</i>	..	..		60.0	65.3	5.3
<i>Brachiaria decumbens</i>	..	..		72.9	78.1	5.2
<i>Cynodon plectostachyum</i>	..	..		67.0	77.0	10.0
<i>Chloris gayana</i>	..	..		70.1	74.8	4.7
<i>Hyparrhenia rufa</i>	..	..		63.4	69.9	6.5
<i>Setaria sphacelata</i>	..	..		65.0	70.0	5.0
<i>Panicum maximum</i>	..	..		68.1	74.6	6.5
<i>Rhynchelytrum repens</i>	..	..		63.5	69.2	5.7
<i>Paspalum notatum</i>	..	..		66.2	69.7	3.5
Mean	..	..	..	66.5	72.5	

The differences are not regular but they are of the same order except in the case of *Cynodon* but on the whole there is less sampling error and replicates agree better if all the sample is passed through the 3 mm. sieve.

TIME OF SAMPLING.

In the course of routine advisory work it is not often possible to pick and choose sampling time. In some cases samples may be taken when the soil is very hard and dry and in others when the reverse is true. Although all samples are air dried before analysis it is possible that the soil moisture at the time of sampling may affect the crumb percentage. This year advantage was taken of a pronounced dry season to sample the Kawanda grass experiment when the soil was bone dry and again a few months later when it was very wet. The plots had been opened for cultivation in the interim. The results are shown in Table 2.

TABLE 2.—EFFECT OF SOIL MOISTURE CONTENT AT TIME OF SAMPLING ON % CRUMB.

Cover.				% Water-stable crumbs over $\frac{1}{2}$ mm. 3 sieves.		
				Sampled dry February.	Sampled wet June.	Difference.
<i>Pennisetum purpureum</i>	..	..		72.4	69.0	3.4
<i>Pennisetum polystachyon</i>	..	..		66.7	60.0	6.7
<i>Brachiaria decumbens</i>	..	..		71.3	72.9	—1.6
<i>Cynodon plectostachyum</i>	..	..		71.5	67.0	4.5
<i>Chloris gayana</i>	..	..		72.6	70.0	2.6
<i>Hyparrhenia rufa</i>	..	..		67.4	63.4	4.0
<i>Setaria sphacelata</i>	..	..		69.2	65.0	4.2
<i>Panicum maximum</i>	..	..		71.4	68.1	3.3
<i>Rhynchelytrum repens</i>	..	..		64.5	63.5	1.0
<i>Paspalum notatum</i>	..	..		68.3	66.2	2.1
Mean	..	..	..	69.3	72.5	

At the end of the dry season the covers were slashed and fired before digging and about fifteen inches of rain fell between the two samplings. Taking these facts into consideration, the soil moisture content at the time of sampling does not appear to make any material difference to the crumb structure as determined by analysis.

These plots will now be cultivated for a minimum of three years to follow the effect of cultivation and to find out, if possible, how much cultivation, *i.e.*, down to 40—30 per cent. of crumb. It will be interesting here to repeat Table 5 of last year's report adding a further column for the fourth year of rest (1946) as this completes the testing cycle.

TABLE 3.—KAWANDA: SOIL STRUCTURE DEVELOPMENT UNDER DIFFERENT GRASSES.

Gross crumb 3 sieves.

Type of Cover.			% Water-stable crumb over $\frac{1}{2}$ mm.				
			1942.	1943.	1944.	1945.	1946.
<i>Pennisetum purpureum</i>	..	..	56.2	61.8	72.3	76.7	76.3
<i>Pennisetum polystachyon</i>	..	..	52.5	50.9	61.2	69.9	65.2
<i>Brachiaria decumbens</i>	..	..	56.7	61.7	70.8	79.0	78.1
<i>Cynodon plectostachyum</i>	..	..	57.9	59.4	67.5	76.9	77.0
<i>Chloris gayana</i>	..	..	56.8	59.3	68.0	74.6	74.8
<i>Hyparrhenia rufa</i>	..	..	55.1	54.7	61.1	74.5	69.9
<i>Setaria sphacelata</i>	..	..	58.2	55.2	66.8	73.7	70.0
<i>Panicum maximum</i>	..	..	59.0	52.4	64.5	73.5	74.6
<i>Rhynchelytrum repens</i>	..	..	55.3	49.7	63.2	71.5	69.2
<i>Paspalum notatum</i>	..	..	55.7	58.1	65.4	79.0	69.7
Mean	..	..	56.3	56.3	66.1	74.9	72.5

The figures quoted for 1945 and 1946 were obtained by not breaking down the large crumbs before sieving in water. The mean difference between the two methods as given in Table II is 3.2 which should be deducted from the 1945 and 1946 means for a straight comparison. It is clear then that the grasses have very little effect on soil structure during their first year. This may easily be due to the fact that the grass roots take that time to get a grip on the soil and to become properly established. Then crumb formation is rapid until the maximum crumb content characteristic of the particular soil-cover combination is reached. In this case the optimum was reached in the third year but here the soil was not in bad condition when the grasses were planted. The fourth year of rest produced no improvement, there are even some signs of deterioration. This is particularly true of *Paspalum notatum* which seems to form such a thick mat as almost to choke itself. If this result is confirmed in further work it would probably pay to loosen the sod of the ley occasionally by light discing say every second or even third year in the case of a long ley.

SERERE FERTILITY EXPERIMENT.

The results from the 5th cycle of this experiment follow on general lines those from the other cycles previously recorded but no significant differences emerge except that grass covers are better than green manures. This result was only significant with the figures from the single half millimetre sieve.

TABLE 4.—SERERE FERTILITY EXPERIMENT CYCLE V.

% Water-stable crumbs over $\frac{1}{2}$ mm. diameter.

Treatment.	Three sieves.	One sieve.
TIME OF REST.		
1 year's rest	34.3	30.6
2 years' rest	34.7	30.8
3 years' rest	36.1	32.5
Significant Difference	Nil	Nil
RESTING COVER.		
A Weeds	34.8	31.4
B <i>Cynodon</i> dug in	37.0	33.1
C Legume slashed	35.3	30.5
D <i>Cynodon</i> slashed	34.7	32.5
E Legume dug in	33.4	29.1
Significant Difference	Nil	Grass better than legumes 100 : 1
MANURES.		
No manure	34.8	31.4
2½ tons Farm yard manure	34.8	31.0
5 tons Farm yard manure	35.6	31.6
Significant Difference	Nil	Nil

During the year the normal rotations at Ngetta and at the Kumi and Katakwi prison farms were sampled and analysed with the following results:—

TABLE 5.

Treatment.	Gross crumb % over $\frac{1}{2}$ mm.		
	Ngetta.	Kumi.	Katakwi.
Cultivated 1 year	55.3	..	28.9
2 years	49.6	44.0	30.8
3 years	38.7	35.8	28.9
4 years	..	37.0	..
Rested 1 year	52.7	35.2	33.6
2 years	51.7	37.5	32.8
3 years	44.6	50.4	33.4
4 years	..	41.0	..

The samples from Kumi and Katakwi are from normal farm blocks unreplicated so that statistical examination is impossible. Nevertheless there are indications that even in these soils, which are more sandy than any previously examined, grasses do regenerate crumb structure.

COTTON SEED AND MEAL EXPERIMENT.

It is generally accepted that cotton is a bad crop for the land but this generalisation is based on observation in cotton monoculture areas such as the Southern States of America. There seemed to be no data available on the soil fertility effects of returning to the soil every part of the cotton crop produced except the lint which as pure cellulose could never be considered a drain on the land. Another by-product of the cotton industry, cotton seed oil, can also be sold off the land without loss of mineral nutrients. An experiment was planned in 1936–37 to compare the effects of cotton seed

meal applied at three different levels comparable with the amounts produced by average to good crops. Normally at the end of the harvest all the residues of the cotton crop have to be uprooted and burnt on account of pests and diseases. Usually the native cuts the old plants off at ground level and stacks them on a termite mound to dry and burn and the ash rarely gets back to the plot which supplied it. One disposal treatment therefore must be the spreading of the residual ash over the plot. The disposal of the cotton residues by burning is most wasteful of nitrogen in any case and we thought we would find out if any benefit was obtained by digging all the residues back into the soil which produced the crop. The final design of the experiment therefore superimposed three methods of residue disposal ((a) carried off, (b) dug in and (c) burnt and the ash scattered back over the plot) with three levels of dressing of cotton seed and of cotton seed meal. The dressings of the latter were 0, 150 lbs. and 300 lbs. per acre and double these quantities of rotted seed were used. The design was a quasialatin square which was laid down at 4 centres: Ngetta, Mbale, Serere and Bukalasa. These very small applications of manure had no effect whatever on the yields of either grain or cotton and it was decided in 1939 greatly to increase the dosage. At the same time there was considerable discussion as to the wisdom of including a treatment involving incorporation of residues in the soil on the ground that the African farmer would never do it properly and the chances of spreading pests and diseases would be greatly enhanced. As a result of this controversy the experiment was restricted to Serere and Bukalasa and the dressings of meal were increased to one and two tons per acre and of seed double these quantities. The results available from Bukalasa are given in Table 6.

TABLE 6.—BUKALASA: COTTON SEED AND MEAL EXPERIMENT.

Yields in pounds per acre.

				Sorghum 38-39.	Cotton 39-40.	Cotton 40-41.
SEED v. MEAL.						
Seed	..	..	..	1,257	1,508	1,644
Meal	..	..	..	1,298	1,543	1,666
Significant Difference				.. None	None	None
SEED AND MEAL.						
Level 0	..	..	..	1,379	1,618	1,604
Level 1	..	..	..	1,186	1,490	1,646
Level 2	..	..	..	1,268	1,472	1,712
Significant Difference				.. 107	None	None
PLANT RESIDUES.						
Carted off	..	..	..	1,222	1,508	1,624
Dug in	..	..	..	1,262	1,506	1,648
Burnt and Ash distributed	..	..	..	1,290	1,553	1,692
Significant Difference				.. None	None	None

It will be seen that cotton derived no benefit from the manures and that the yield of sorghum was actually reduced. This is very strong land, however, and more interesting results were obtained at Serere. The cotton data from the first year of the Serere experiment are shown in Table 7.

TABLE 7.—SERERE: COTTON SEED AND MEAL EXPERIMENT 1939-40. COTTON DATA.

Comparison.	Seed cotton lbs. per acre.	Vegetable matter lbs. per acre.	Phosphate parts per million.	Potash parts per million.	Blackarm lesions per plant.	Lint length mm.	Lint index.	Wt. of 100 seed in grms.	Ginning %
SEED & MEAL—									
Seed 2 tons per acre ..	231	2,192	8	166	0.44	27.2	3.50	8.14	30.1
Meal 1 ton per acre ..	267	2,948	26	189	0.36	27.0	3.49	8.22	29.8
Significant Difference ..	21	278	11	18	None	None	None	None	None
SEED AND MEAL DRESSINGS—									
Level 0 ..	225	2,028	4	155	0.58	27.3	3.54	8.09	30.5
Level 1 ..	255	2,613	23	200	0.36	27.0	3.47	8.14	29.9
Level 2 ..	267	3,070	24	178	0.26	27.0	3.48	8.32	29.5
Significant Difference ..	25	341	13	22	0.18	None	None	0.15	0.4
PLANT RESIDUE DISPOSAL—									
Carted off ..	234	2,353	21	180	0.47	26.8	3.52	8.17	30.1
Dug in ..	258	2,571	15	165	0.43	27.1	3.46	8.13	29.9
Burnt and ash distributed ..	255	2,787	15	188	0.29	27.3	3.50	8.24	29.8
Significant Difference ..	None	341	None	None	0.18	None	None	None	None

During this season many detailed observations of plant and crop were carried out by the Senior Botanist and soil samples were examined for carbon, nitrogen, calcium, potash and phosphate. The cotton yields and the total weight of vegetable matter both responded to manuring with cotton seed meal rather than to the heavier dressing of seed which would not be expected to break down so quickly. This is reflected in the phosphate and potash figures which also show the effects of manuring especially with meal but no other nutrients show significant differences. An interesting feature in the table is the reduction of Blackarm with manuring and with the application of the ash after burning the crop residues. This seems to be directly attributable to potash because there is a significant negative correlation between Blackarm and potash.

Another not unexpected result is that the fatter land produces heavier seeds and automatically the ginning out-turn is reduced. Another manurial dressing was given to the cotton crop in the 1940-41 season on the same plots with the results shown in table 8.

TABLE 8.—SERERE: COTTON SEED AND MEAL EXPERIMENT.
Season 1940-41 Manure re-applied 1940 Cotton data.

	Blackarm lesions per plant.		Seed cotton lbs. per acre.	Wt. of 100 seed in grms.	Lint index computed	Ginning %
SEED v. MEAL.		*				
Seed 2 tons per acre ..	2.57	2.57	537	9.47	4.10	30.25
Meal 1 ton per acre ..	2.00	2.01	603	9.53	4.13	30.22
Significant Difference ..	0.36	0.37	None	None	None	None
SEED AND MEAL.						
Level 0 ..	2.83	2.96	410	9.31	4.03	30.38
Level 1 ..	2.20	2.18	610	9.52	4.12	30.25
Level 2 ..	1.83	1.73	690	9.68	4.17	30.08
Significant Difference ..	0.44	0.45	85	0.49	0.08	0.25
PLANT RESIDUES.						
Carted off ..	2.02	2.06	537	9.46	4.11	30.29
Dug in ..	2.40	2.39	587	9.50	4.11	30.25
Burnt and ash dis- tributed ..	2.44	2.43	586	9.55	4.12	30.17
Significant Difference ..	None	None	None	None	None	None

Here again yields are increased as is seed weight by manuring and, as before, Blackarm is less. This suggests that the degree of attack by Blackarm is related to nutrient supply but caution is needed in interpretation because cotton often produces big plants with no crop on strong land.

A final crop of *Eleusine* was taken in 1942 after which the experiment rested under grass until 1945 when the land was re-opened to groundnuts followed by sorghum to discover what effects remained of the second

*Figures adjusted for plant height.

TABLE 9.—SERERE: COTTON SEED AND MEAL EXPERIMENT.

Crop yields in lbs. per acre. Manure applied to cotton in 1939 and 1940.

Treatment.	Cotton 1939-40.		Eleusine head.		Cotton 1940-41.		Eleusine head.		Groundnuts 1945.		Sorghum 1945.	
	Seed.	Meal.	Seed.	Meal.	Seed.	Meal.	Seed.	Meal.	Seed.	Meal.	Seed.	Meal.
Nil	..	..	231	220	410	410	1,176	1,148	698	700	584	550
Level 1	..	..	222	288	579	641	1,396	1,534	813	661	744	897
Level 2	..	..	241	293	623	757	1,836	2,203	723	622	582	882
							1,888	2,522				
Increase : Level 1	..	..	—9	68	169	231	440	669	115	—39	160	347
Level 2	..	..	10	73	213	347	492	978	25	—78	—2	332
Cost in shillings.					Increased returns per acre in shillings and cents.						Gross return.	
Seed.											Seed.	Meal.
Meal.												
Level 0	..	..									6.40	13.88
Level 1	58	70	—1.08	8.16	20.28	27.72	17.60	26.76	8.05	—2.73	87.37	110.03
Level 2	116	140	1.20	8.76	25.56	41.64	19.68	39.12	1.75	—5.46	91.43	148.38

It is quite evident from these figures that a reasonable return can be obtained from a single dressing of either material provided that transport charges are not too high.

application of manure in 1940. The total crops are summarised in Table 9. It is clear that the major effects are obtained by the use of cotton seed meal and that the return per unit of manure applied decreases between level 1 and level 2. Against this we have the fact that the seed is widely distributed throughout the country and the use of meal involves increased costs as seed has to be bagged, carted to the mills and the meal carted back to the land. The cost of seed is reckoned at fourteen shillings and six pence per ton unbagged at the ginnery and that of meal at thirty five shillings unbagged at the mills. Cotton is priced at twelve shillings per 100 lbs., *Eleusine* and sorghum millets in the head cost four shillings for the same weight. Bagging and transport charges have been omitted as these would vary with quality of bags and distance carted. In any case the balance sheet in Table 9 can only be taken as a rough approximation.

TABLE 10.—SERERE: COTTON SEED AND MEAL EXPERIMENT.

	1942.	1945.
SEED v. MEAL.		
Seed 2 tons	38.5	53.4
Meal 1 ton	39.4	50.7
Significant Difference	None	Seed > Meal 20 : 1
SEED AND MEAL.		
Level 0	40.2	54.9
Level 1	40.2	52.2
Level 2	36.5	48.9
Significant Difference	None	Level 2 < others 100 : 1
PLANT RESIDUES.		
Carted off	39.7	53.3
Dug in	38.5	51.7
Burnt and ash distributed	38.7	51.0
Significant Difference	None	None

Manures were applied in 1939 and 1940 but there was no sign of their having affected crumb formation. The three years of rest prior to re-opening in 1945 markedly increased the percentage of crumb but the only significant differences were in favour of seed as against meal and the heavy dressings actually reduced the rate of crumb formation. Next year another Serere experiment comparing cotton seed and cotton seed ash, will be due for re-opening for an index crop to test residual effects. When those results are available it will be well to consider all the results together to decide whether it is worth while designing a new 3 × 3 experiment to shed further light on one or two obscure interactions observed in the separate tests.

NICOTINE AND ROUTINE.

The results of the work on nicotine have already been summarised in the report on the Western Province. The ordinary routine work produced no results of general interest.

ACKNOWLEDGEMENTS.

It is a pleasure again to thank Agricultural Officers and the Senior Botanist for their co-operation in field work and assistance in the statistical reduction of the results.

W. S. MARTIN,
Senior Chemist.

REPORT OF THE ENTOMOLOGIST

Advisory Work and General

Throughout the year advice on entomological problems was given to departmental and other enquirers. Specimens were identified on request, including several sent in by the Forestry Department. Work on the collection at Kawanda was continued and several hundred specimens (kindly identified by the Imperial Institute of Entomology, London, whose help in this connection is gratefully acknowledged) were added to it. Scale drawings in colour were made from life of immature stages of Uganda insects, mainly *Lepidoptera* and following precise identification were added to the already extensive collection of such drawings at Kawanda. Some twenty consignments of incoming and outgoing plant-material, mainly seeds, were examined during the year and, where necessary, were fumigated.

Locusts

(a) DESERT LOCUST (*Schistocerca gregaria*, FORSK.).

This was the only locust present in Uganda during the year, and its activity during April-June has been discussed in the 1944-45 report of this section. Throughout the rest of the year its movements were on a small scale and were confined to north-east Uganda. No breeding took place and no appreciable crop damage has been reported.

(b) RED LOCUST (*Nomadacris septemfasciata*, SERV.).

This locust was absent from Uganda during the year. Owing to its activity in the Lake Rukwa (Tanganyika) outbreak centre, preparations were made to deal with a possible invasion, and a scouting system was organised in the uninhabited areas of south-western Uganda. The assistance of the Provincial Administration in organising this scouting system is acknowledged.

Cotton Capsids

It was decided that cotton capsid pests of cotton should be the main subject for investigation by the section and that previous studies on *Lygus simonyi* Reut. should be continued.

The 1945-46 cotton season at Kawanda and Serere was abnormal for both stations owing to the carrying out of a late planting policy. No cotton was planted at Kawanda before June 27th, and the April-May sowings at Serere were reduced to a few plots, totalling less than an acre, on Block Z of the experiment farm.

The writer spent August and September at Serere where he studied chiefly the May-sown cotton. He returned to Kawanda in October in time to make observations on the June, July and August sowings.

(a) SERERE.

The 1944-45 dry season was unusually long lasting until the end of April. During the first four months of 1945 there were only 5.70 inches of rain as against the average of 14.66 inches for the same period over the last fifteen years. In late April the Teso countryside was still brown and parched and showed a complete absence of the new young plant growth which is generally regarded as necessary for *Lygus* (Taylor, 1945 b.). The grain crops, which are probably the most important alternate hosts in this area of the *Lygus* species found on cotton, were not planted until May nor were they harvested until August. These crops are normally sown about March and reaped about June.

Following the beginning of the rains in May, the rainfall was heavier than usual, the six months May-October totalling 44.23 inches compared with the 1921-45 average of 33.02 inches.

The lack of new plant growth in the early part of the year prevented any build up of the *Lygus* population before July. A survey was made by Mr. Mubbiru of *Lygus* on *Eleusine* millet during July and early August.

The net sweeping technique, introduced and described by Gwynn (1937) was used to measure levels of capsid populations throughout the season at Serere and Kawanda. Sweeping was done with a standard net having a mosquito-netting bag, 15 inches in diameter at the mouth and 18 inches in depth. The bag was mounted on a cane ring with a handle about 6 inches long. All sweeping surveys described in this report were made by three experienced African assistants. It is realised that this technique has many disadvantages and cannot be relied upon to give more than a rough index of capsid populations. Unfortunately no other practicable method is known of getting such an index. A similar technique has recently been used by Lieberman (1946) and Sorenson, and Carlson (1946) for the estimation of *Lygus* populations on alfalfa in Nebraska, U.S.A.

In the survey on *Eleusine*, 1,500 sweeps were made on each of six occasions. The results are given in Table:—

TABLE I.

Date.	Catch per 100 sweeps (from 1,500 sweep totals).			Remarks.
	<i>L. simonyi</i> adults.	<i>Lygus</i> "A" adults.	<i>Lygus</i> nymphs.	
5-7-46 ..	1.5	0.4	0	Young and half grown heads of grain.
10-7-46 ..	2.1	1.5	0.4	Half grown heads.
17-7-46 ..	2.3	0.9	1.5	Half grown and maturing heads.
24-7-46 ..	3.3	0.5	1.7	Maturing heads.
31-7-46 ..	6.5	0.3	5.3	Harvest beginning.
7-8-46 ..	8.0	0.2	6.0	Harvesting.

The maximum average catch of *simonyi* adults per 100 sweeps was 8, taken in early August when the grain was ready for harvest. A similar survey made by Gwynn in June, 1937, gave averages per 100 sweeps of

12-14 *simonyi* adults. The year 1937 at Serere differed markedly from 1945 in that it received heavy early rains. It is probable that the long 1944-45 dry season not only prevented *Lygus* breeding on alternate hosts, but also reduced the population of adults attempting to carry over to the succeeding rainy season. This would account for the smaller population observed on *Eleusine* in 1945. The difference is not likely to be due to a higher incidence of parasites in 1945. Observations made in 1945 indicate that the parasitism of *Lygus* nymphs on grain crops was of the usual low order of about 2%.

It will be noticed from Table I that the *Lygus* population on *Eleusine* was dominantly *simonyi*. A survey was also made by Mr. Mubbiru of *Lygus* in half grown Sorghum heads at Serere in July. Ten heads at a time were shaken into a net and the catch removed and counted. The results are given in Table II.

TABLE II.

Date.	<i>Lygus</i> populations shaken from 500 heads of Sorghum.		
	<i>Lygus simonyi</i> adults.	Green <i>Lygus</i> adults.	<i>Lygus</i> nymphs.
6-7-46 ..	2	140	0
13-7-46 ..	1	169	2
20-7-46 ..	2	247	123
27-7-46 ..	4	209	31

This survey showed that *simonyi* formed a very small proportion of the *Lygus* population. It would appear that in 1945 at Serere, Sorghum was a less important alternate host of *L. simonyi* than *Eleusine*.

The May sown cotton at Serere had no lack of rain and grew strongly. From the beginning of July onwards it was presumably as attractive to *Lygus* as it is possible for cotton to be. It was certainly most "succulent". Despite this and despite the fact that *Eleusine* growing in the same area was developing substantial *Lygus* populations, the cotton remained virtually free of *Lygus* until the grain crop harvest in August. Sweeping surveys made in July failed to take any *Lygus* and careful examination at the end of this month showed that only 50 plants out of approximately 9,000 showed signs of damage. This damage was light to very light. This confirms observations by Gwynn made at Serere in 1937, on cotton which was sown in February adjacent to a crop of *Eleusine*. It developed little or no *Lygus* until the *Eleusine* was harvested, although the latter crop had built up an appreciable population of the pest. It would appear that under Serere conditions, cotton is not as attractive to *Lygus* as *Eleusine* nor is it so suitable for the rapid multiplication of the pest.

The main *Lygus* attack on cotton developed during August (following the *Eleusine* harvest), reached its maximum in September, and declined during October. By mid November it had virtually finished. During September a total of 2,350 net-sweeps were made on June and July-sown cotton on various parts of Serere farm. The results are set out in Table III.

TABLE III.

Date.	Capsid populations from cotton taken in 100 sweeps of net.					No. of sweeps made on each date.
	<i>L. simonyi</i> adults.	<i>Lygus</i> "C" adults.	<i>Lygus</i> nymphs.	<i>Megacoelum apicale</i> adults.	<i>Megacoelum</i> nymphs.	
3-9-46 ..	8.4	14.8	5.6	10.4	0	250
5-9-46 ..	6.6	3.8	0.4	2.8	0.4	500
10-9-46 ..	4.0	6.3	1.0	2.7	1.7	300
15-9-46 ..	4.4	5.0	3.8	3.2	2.8	500
17-9-46 ..	3.7	1.5	2.0	1.7	0.7	300
18-9-46 ..	7.2	9.8	2.8	2.8	1.6	500
Mean ..	5.8	6.3	2.5	3.5	1.3	Total 2,350

The average catch of adult *Lygus* of both species was 12.1 per 100 sweeps. Gwynn considered 17.6 *Lygus* adults per 100 sweeps to be a "fairly high figure". The above average is well below Gwynn's figure and the 1945 attack may be said to have been of no more than moderate severity.

Adults of *Megacoelum apicale* Reut. averaged 3.5 per 100 sweeps, or 22% of the adult capsids taken on cotton. Gwynn found that *M. apicale* was "seldom numerous at Serere where it varied from 2½% to 12% of the adult capsid population early in the season". September, 1945 was the ecological equivalent of July, 1937, and it would appear that the 1945 *M. apicale* population at Serere was relatively large.

From August to November plant diagrams were made by the writer and Mr. Mubbiru of 36 plants in the Variety × Sowing Date trial on Block Z. Twelve plants were chosen in each of the three sowing date treatments (May 16th, June 20th and July 25th respectively), and each group of twelve was made up of random pairs of plants from each of the six varieties represented. These diagrams were made at 7-10 days intervals, beginning when the plants were about ten weeks old. They were modelled on those made by Taylor, and proved of value in that the making of them familiarised the writer with the cotton plant. They had the drawback of providing much non-essential detail which tended to prevent their interpretation, the recording of which took much time. It is felt that in future a simplified form of plant diagram should be used.

By the end of August the first sowing (planted on 16th May) was well grown, and the plants had long lower primary sympodia. As the main *Lygus* migration did not begin until the second half of August, this sowing may be said to have developed its bottom growth in the absence of *Lygus* attack. By contrast, the third sowing (planted on 25th July) was old enough to be susceptible to *Lygus* in early September and developed thereafter under sustained attack until early November when the plants showed the usual signs of *Lygus* damage, and when they were about the same age as the first sowing in late August; i.e., 105-110 days old. Table IV gives data obtained on 28th August for the first five primary sympodia of the twelve May-sown plants and similar data obtained on 12th November from the July sowing.

TABLE IV.

Variety.	No. of nodes in main stem.	Totals for first five primary sympodia.				
		Nodes.	Bolls.	Squares and flowers.	Total Fruiting Points carried.	Leaves with <i>Lygus</i> damage.
BP 50 ..	25	30	10	11	21	9
" ..	25	31	14	8	22	10
SP 84 ..	20	20	5	11	16	6
" ..	22	29	14	8	22	4
S 4105 ..	23	27	12	10	22	8
" ..	22	27	12	9	21	1
B 181 ..	23	33	8	14	22	11
" ..	24	30	12	18	30	2
BP 52 ..	22	25	7	9	16	4
" ..	23	28	12	13	25	3
N 17 ..	23	23	4	9	13	5
" ..	22	28	8	11	19	11
Total ..	274	331	118	131	249	74
Mean ..	22.8	27.6	9.8	10.9	20.75	6.18
BP 50 ..	24	22	1	1	2	19
" ..	24	19	5	2	7	19
SP 84 ..	24	20	3	0	3	10
" ..	25	25	2	0	2	19
S 4105 ..	25	28	0	5	5	19
" ..	26	24	2	6	8	20
B 181 ..	24	24	4	4	8	15
" ..	26	36	4	6	10	29
BP 52 ..	25	28	4	1	5	19
" ..	24	24	0	5	5	21
N 17 ..	24	21	2	3	5	17
" ..	25	24	0	0	0	20
Total ..	296	295	27	33	60	227
Mean ..	24.7	24.6	2.25	2.75	5	18.9

The following conclusions may be drawn from Table IV:—

(1) The attack was much more severe on the July sowing as is shown by 18.9 leaves per plant (77%) having *Lygus* damage as against 6.18 leaves (22%) in the May sowing. This difference is statistically significant at $p=0.01$.

(2) The heavier attack on the July sowing was associated with higher loss of fruiting points, only 5 per plant (20% of those produced) being retained as compared with 20.75 (75%) on the May sowing. This difference is also statistically significant at $p=0.01$, and it probably partly accounts for the fact that the May sowing yielded four times as much as the July sowing. Some of the May sown plots in this trial averaged more than 1,000 lbs. of seed cotton per acre which is an unusually high yield for Serere.

(3) The heavier attack on July sowing did not seriously reduce the number of nodes on the basal primary sympodia. The July sowing had a mean of 24.6 (5.5 per sympodium) in the May sowing and the difference

observed is not statistically significant. This would indicate that Taylor's Branch G node count may not be a reliable index of the severity of attack.

Examination of May-sown plants in August, before the main *Lygus* migration, showed that monopodia were developing freely on all plants in the axils of primary sympodia. Taylor had observed this production of monopodial axillary branches and suggested that it followed loss of sympodial terminal buds through *Lygus* attack. He does not appear to have observed Uganda cotton growing in the absence of *Lygus* attack. The production of monopodial branches in the axils of healthy, undamaged primary sympodia appears to be a feature of Uganda cottons.

(b) KAWANDA.

Surveys were made by the writer and African staff of the incidence of *Lygus* and *Megacoelum* on cotton throughout the season. The net sweeping technique described by Gwynn was used and each estimate of capsid incidence in each cotton field (averaging 3 to 4 acres per field) was derived from a minimum of 500 strokes of the net.

The 1945-46 season was preceded by an unusually long dry season which lasted until the end of April, 1945. The first four months of 1945 totalled 12.62 inches of rain as compared with the Kawanda average for 1936-45 of 15.58 inches. The difference was more pronounced than the figures indicate because about 5 inches of the 1945 total fell in the last week of March in four heavy showers. Much of this was lost by run-off and the remainder was rendered non-effective by hot dry weather in April, which had 1.14 inches of rain as against the 1936-45 average of 6.45 inches. The rainfall for the remaining eight months of the year was not much below the 1936-45 average (28.07 inches as compared with 29.51 inches) but was badly distributed. May and August together had more than 14 inches while the seven week period from mid-September to early November totalled only 2.50 inches. The latter period contained a 30 days drought (September 18th-October 17th) when only 0.34 inches of rain were recorded. The last three months of the season, January-March, 1946, were hotter and drier than usual. Their rainfall totalled only 4.35 inches as compared with the 1936-45 average of 9.13 inches. A shade maximum temperature of 96°F occurred in late February. This is the highest ever recorded at Kawanda.

The failure of the April rains affected the incidence of *Lygus* throughout the season. Alternate hosts such as *Pseudarthria* did not come into growth until after the heavy rains of May, instead of in March-April as described by Taylor. These wild hosts were kept in a state of luxuriance by the heavy rains in August and did not dry up until the September-October drought referred to above. As Taylor has pointed out, the annual migration of *Lygus* on to cotton at Kawanda follows closely on the drying out of the wild host plants. In 1943, when his studies were made, this drying out occurred during June and July and the main incidence of *Lygus* on cotton followed in July and August. In 1945, the wild hosts did not dry up until September and October and the main *Lygus* attack on cotton would, therefore, be expected to develop during October and November. This expectation was in fact realised. *Lygus* populations on cotton were negligible during August, increased sharply during September, and reached a peak on all fields in late October and early November. Populations then declined slowly during the remainder of November and December, and rapidly during January when all fields were drying up. February populations were negligible. The incidence of *Lygus* on Kawanda Main Farm cotton is set out in Table V. The cotton variety grown was BP 52.

TABLE V.

Incidence of *Lygus* spp. on BP 52 cotton at Kawanda expressed as number caught in 100 strokes of standard net.

Field and date of planting.	September.	October 1-15.	October 16-31.	November.	November.	December.	January.
Block IX and Block X, Strip 1, 27th June to 2nd July ..	3.7	2.6	6.4	6.4	0.9	2.6	0.2
	0.5	0.3	0.6	1.2	0.1	0.2	0.0
	1.1	3.8	6.8	4.1	3.1	1.4	0.5
	5.3	6.7	13.8	11.7	4.1	4.2	0.7
							TOTAL.
Block X, Strip 4, 5th and 6th July ..	2.0	no figures	0.6	1.8	1.2	0.8	0.2
	0.3	figures available	0.2	0.0	0.0	0.0	0.0
	0.2		0.6	7.0	0.8	0.8	0.2
	2.5		1.4	8.8	3.0	1.6	0.4
							TOTAL.
Block IX, Strip 8, 16th and 17th July ..	no figures	no figures	1.0	2.2	1.6	1.8	1.0
	figures available	figures available	0.2	0.0	0.0	0.0	0.0
			1.4	4.2	2.0	2.8	0.8
			2.6	6.4	3.6	4.6	1.8
							TOTAL.
Block IX, Strip 6, 18th and 19th July ..	2.6	no figures	1.0	2.6	1.0	1.6	0.7
	0.2	figures available	0.2	0.0	0.2	0.0	0.0
	0.2		0.6	2.0	2.0	2.8	1.0
	3.0		1.8	4.6	3.2	4.4	1.7
							TOTAL.
Block VIII, Strip 6, 8th August ..	0.0	2.2	7.0	5.6	2.5	2.1	1.2
	0.0	0.0	1.0	0.2	0.2	0.0	0.0
	0.0	0.6	4.8	2.0	3.3	3.0	0.6
	0.0	2.8	12.8	7.8	6.0	5.1	1.8
							TOTAL.

Block IX and Block X, Strip 1, 27th

June to 2nd July ..

Block X, Strip 4, 5th and 6th July ..

Block IX, Strip 8, 16th and 17th July ..

Block IX, Strip 6, 18th and 19th July ..

Block VIII, Strip 6, 8th August ..

The data in Table V are derived from a grand total of 29,000 strokes of a standard net, and, as has been stated above, each group of figures for a month or for a fortnight is based on the results of a minimum of 500 net strokes.

The following points emerge from the table:—

(1) The fact that the peak incidence occurred simultaneously on the earliest and latest sown fields (Block IX and X strip 1, and Block VIII strip 6 respectively) would indicate that it was brought about by factors not connected with the cotton itself. It cannot be said that the earlier sown cotton bred up a population which then spread to the later sowings.

(2) Block IX and X strip 1, and Block VIII strip 6 showed a heavier infestation throughout the season than the other three strips, and this was reflected in heavier leaf damage. IX and X strip 1 and VIII 6 showed obvious signs of attack while IX 6 and 8, and X 4 looked clean and relatively undamaged. This may be accounted for by the fact that the latter three strips were bounded and closed in by elephant grass while the former three were open and had little elephant grass within 50 yards. The tall elephant grass may have acted as a barrier to migrating adults and so shielded IX 6 and 8 and X 4 from attack. Also Taylor states that the capsid fauna of elephant grass maintains a supply of those species of *Euphorus* which parasitise *Lygus* nymphs. The proximity of elephant grass to the cotton might therefore encourage biological control of *Lygus*.

(3) The incidence of *Lygus* "C" was low. Over the season as a whole it averaged 8%, and never at any time exceeded 20%, of the adult *Lygus* population.

(4) The incidence of *Lygus* spp. on IX and X strip 1 during the second half of October and the first half of November was about the same as that at Serere during September (see Table III), i.e., about 12–14 adults and nymphs per 100 net strokes. The incidence of *L. simonyi* on these fields at Kawanda was, however, rather higher than at Serere.

Block IX strip 1 and Block X strip 1 were treated as one field. They were planted in the same operation and adjoined end to end being separated by only a few feet of farm road. The incidence of *Lygus* on these two strips, as shown by net sweeping and leaf damage counts, was very similar. In spite of this, the north half of XI appeared to the eye to be much less attacked than the rest. The plants here remained short and matured early while the plants in the rest of XI and all of IX 1 grew tall and lanky and were noticeably later in producing their crop. The reason for this difference is not known.

Leaf damage counts by Gwynn's method were carried out in October on IX, 1, on X, 1, and X, 4, 500 plants per strip were examined, being selected at random along its length. IX, 1 totalled 1,218 units of *Lygus* damage, X, 1 had 1,444 units, while X, 4 had 864 units. It will be noticed that although half of X, 1 appeared to the eye to be less attacked than IX, 1, the field as a whole had in fact more damage. It will also be noticed that X, 4 was much less damaged than either IX, 1, or X, 1 thus confirming the figures for *Lygus* incidence obtained by the sweeping technique.

In February, Branch G node counts were made on 50 plants in each of five of the fields listed in Table V. The results of these counts and also the yields of seed cotton from the fields are set out Table VI.

TABLE VI.

	Block IX	Block X	Block X	Block IX	Block IX	Block VIII
	Strip 1.	Strip 1.	Strip 4.	Strip 8.	Strip 6.	Strip 6.
Branch G node count average per plant	2.78	1.86	2.64	—	2.76	4.02
Yield in lbs. of seed cotton/acre	1,015	1,041	1,058	803	888	731
Figures in brackets=percentage clean cotton	(94)	(92)	(97)	(97)	(98)	(97)

If Table V and Table VI are compared it will be noticed that neither Branch G node count nor yield appear to be obviously related to the incidence of *Lygus*. Block IX, 1, which had a much heavier *Lygus* infestation than X 4, nevertheless had rather more nodes on its G sympodia, while the yields were very similar. Block VIII 6 had one of the heaviest infestations during its growing season yet its Branch G count was the highest recorded.

The parasitism of *Lygus* nymphs by *Euphorus* spp. was studied. Samples of late instar nymphs from cotton were dissected at intervals, a grand total of over 600 being examined during the season. The average parasitism for October, November and December (the months when nymphs were available in fair quantity) was 55%. A sample from IX, 6 in early November was 80% parasitised and VIII, 6 during the second half of October averaged 70%. Nymphs from IX, and X, 1 were never more than 60% parasitised even when the *Lygus* infestation was at its height. Out of 235 nymphs taken from these two strips in late October and early November, only 52% were parasitised. Parasitism never approached 100% as recorded by Taylor. No cases of more than one parasite per nymph were observed. Taylor found that when adult parasites were plentiful, large nymphs often contained more than one parasitic larva. The absence of this phenomenon supports the conclusion that in 1945 the incidence of parasitism was lower than in 1943 when Taylor made his observations.

The incidence of *Megacoelum apicale* on Kawanda cotton is set out in Table VII.

TABLE VII.

Field.	Incidence of <i>Megacoelum apicale</i> on BP 52 cotton at Kawanda in terms of number taken in 100 strokes of standard net.								
	November.			December.			January.		
	Adults.	Nymphs	Total.	Adults.	Nymphs	Total.	Adults.	Nymphs	Total.
Block IX and X, Strip 1 ..	1.5	1.7	3.2	3.1	4.5	7.6	1.0	3.1	4.1
Block X Strip 4 ..	0.4	1.6	2.0	1.0	2.2	3.2	0.6	1.4	2.0
Block IX Strip 6 ..	0.2	0.0	0.2	0.6	0.6	1.2	0.4	1.3	1.7
Block IX Strip 8 ..	0.0	0.2	0.2	1.2	1.2	2.4	0.3	1.2	1.5
Block VIII Strip 6 ..	0.6	0.0	0.6	0.2	0.6	0.8	1.2	1.6	2.8

The figures in Table VII were obtained during the net sweeping operations made in connection with the incidence of *Lygus*. Each set of monthly figures is based on a minimum of 500 net strokes.

It will be noticed that the peak incidence occurred during December and January or about two months later than that for *Lygus*. This confirms similar observations made by Gwynn and Taylor.

(c) General conclusions from the season's work on cotton capsids.

(1) The incidence of *Lygus* on cotton is related to climate through the influence of the latter on alternate host plants. Any big year to year variation in rainfall will tend to cause equally big variations in the time of onset of attack and possibly in the degree of attack. It would appear to be unwise to conclude that the annual *Lygus* attack will ever conform to a regular schedule. Each year must be treated on its merits.

(2) Observations made in 1945 failed to show that *Lygus* caused serious loss of basal sympodial structure. It would appear that at low to moderate levels of *Lygus* incidence the Branch G node count may not provide a reliable index to the degree of attack.

(3) Observations at Serere show that while increase in *Lygus* attack on cotton was followed by decrease in yield, this decrease was also associated with increased incidence of boll-worms and stainers (*see below*) so the loss of yield cannot be solely attributed to *Lygus*. Work at Kawanda failed to show any clear relation between *Lygus* attack and yield. It has yet to be demonstrated that *Lygus* is a limiting factor in Uganda cotton production.

Cotton Pests other than Capsids

(a) SERERE.

General observations were made on cotton stainers (*Dysdercus* spp. Pyrrhocoridae) until mid-November. Adults of *D. supersticiosus* Sign. and

D. nigrofasciatus Stal were first noticed in early September on May-sown cotton. A few first stage nymphs were seen at the end of September, and more extensive breeding occurred later. Indications were that the infestation was of normal intensity but precise data are not available. Seed cotton from Serere main farm had 83%–88% of unstained cotton which is regarded as about normal. The species present were almost entirely *superstitiosus* and *nigrofasciatus*. A single adult *D. cardal* Gerst. was seen on the Fertility Experiment cotton in October. *D. fasciatus* Sign. was not observed at all.

The incidence of boll-worms (*Platyedra gossypiella* Saund. Gelechiidae; *Argyroplote leucotreta* Meyr., Eucosmidae; and *Earias* spp., Noctuidae) and also of stainer attack was studied by examination of samples of 900 full grown but unopened bolls taken from the discard rows of the Variety by Sowing Date trial, on Block 2. The results are set out in Table VIII.

TABLE VIII.

Date of sowing.	Analysis of Insect Boll Damage on Variety × S.D. trial, Block Z, Serere, 1945–46. Figures=percentage of bolls attacked.					
Date of Examination in brackets.	<i>Platyedra gossypiella</i> .	<i>Argyroplote leucotreta</i> .	<i>Earias</i> spp.	<i>Dysdercus</i> Stained.	<i>Proliferations</i> Unstained	Undamaged.
May 16th (c. Sept., 20th) ..	1·0	2·0	0·5	45·0	9·0	42·5
June 20th (Nov., 16th) ..	2·5	10·0	0·5	50·5	4·0	32·5
July 25th (Dec., 31st) ..	4·0	9·5	2·0	73·0	2·0	9·5

The table shows clearly that boll damage increased as the season went on. The sample taken in late December from the last sowing showed only 9·5% of the bolls to be undamaged as compared with 42·5% undamaged bolls in the sample taken in September from the first sowing. Boll-worm incidence increased from 3·5% to 15·5% and stainer damage from 54% to 75%. Of the boll-worms, *Argyroplote* was the most serious pest, damaging up to 10% of the bolls.

When considering Table VIII it must be borne in mind that the boll samples were taken from a sowing date trial with contiguous plots. Some of the infestation in the later sowings most probably derived from the earlier sown plots, and the later sowings therefore probably show a higher incidence of insect boll damage than if they had been grown in isolation.

As stated above the May sowing in this trial yielded more than four times as much as the July sowing. Part of the difference in yield may well be attributed to difference in degree of *Lygus* attack, but the combined effect of boll-worms and stainers must also have played a considerable part. The difference in yield is as much an expression of boll-worm and stainer attack as it is an expression of *Lygus* attack.

(b) KAWANDA.

The incidence of *Dysdercus* was very low throughout the season and this is reflected in the incidence of stained cotton which was the lowest ever recorded at Kawanda. The figures for clean cotton picked on the main farm are given in Table VI. It will be noticed that most fields yielded at least 97% of clean cotton. No field had more than 8% of stained cotton. No attempt was made to obtain numerical data on the size or nature of *Dysdercus* populations.

Surveys were made of insect boll damage on Kawanda main farm during December and January. Samples of 200 bolls, taken at random from each of three fields, were examined. The results are set out in Table IX.

TABLE IX.

Field. Date of Examination in brackets.		Analysis of Insect Boll Damage on Kawanda Main Farm 1945-46 Figures=percentage bolls attacked. Cotton Variety=BP 52.						
		<i>Platyedra gossypi- ella</i>	<i>Argyro- ploce leucotreta</i>	<i>Earias spp.</i>	<i>Dysdercus Stained</i>	<i>Prolifera- tions Unstained</i>	Bacterial Damaged	Undam- aged Bolls
XI (13 Dec.)	..	1.0	3.0	2.5	31.0	7.0	13.5	42.0
IX 6 (8 Jan.)	..	0.5	2.5	1.5	7.5	3.0	8.0	77.0
VIII 6 (10 Jan.)	..	0.0	3.5	2.0	9.0	6.5	4.5	74.5

It will be noticed that boll-worm damage was low, being of the order of 5% to 6%. As at Serere, *Argyroploce* was the most serious offender.

Bacterial boll rot caused rather more damage than boll-worms. In X, 1, 13.5% of the bolls were attacked by this disease as compared with 6.5% of bolls damaged by boll-worms.

Stainer damage was low, being highest in X, 1 where 38% of the bolls showed proliferations. This figure, however, is lower than the lowest obtained at Serere. (See Table VIII).

The fields in Table IX are arranged in order of planting date, X, 1 being sown at the end of June and VIII, 6 in early August. It will be noted that boll damage was highest in the earliest sowing. The later sowing suffered relatively little. It would appear that the earlier cotton did not penalize later sowings by cross-infestation. This apparently conflicts with results obtained for boll damage at Serere (see above). It must be remembered, however, that the Serere observations were made on small contiguous plots of cotton, while the Kawanda results refer to fields of 3 to 4 acres, and isolated from each other by other cultivation.

Coffee Pests

Little attention was paid to coffee pests owing to shortage of staff.

Arabica coffee at Rubona near Fort Portal was test-dusted with pyrethrum in November. The *Antesia* population was found to be low—less than one adult per tree. No nymphs were found. The adult *Antesia* obtained (all *linearicollis* Stal) were found to be 60% parasitised by

Corioxenos antestiae Blair. It is of interest to note that in 1940 Taylor (1945 (a)) made liberations of *Corioxenos* in Butukuru, about half a mile from Rubona. Subsequent examination showed that the parasite was well established in Butukuru in 1941. Taylor was satisfied that before the liberations, *Corioxenos* was absent from the Rubona-Butukuru area. In 1942, Taylor searched for *Corioxenos* at Rubona but was unable to find it. In late 1944, the writer also failed to find the parasite at Rubona. It has apparently taken five years for the parasite to spread across the half mile of ordinary cultivation and elephant grass between Butukuru and Rubona.

Miscellaneous Crop Pests

Studies were made of white flies (*Bemisia* spp., Aleyrodidae) on Cassava and Sweet Potato, to see if there were crop varietal differences in the incidence of the pests. Counts were made at fortnightly intervals of nymphal and pupal scales on random samples of at least 100 leaves per variety. The results were not conclusive but indicated that varietal preferences probably exist. Populations of scales on all varieties in both crops tended to reach a maximum when the plants were making rapid growth after planting and to decline as the plants became senescent. This plant age effect was sufficiently pronounced to mask partially the effect of varietal differences.

Flax grown in Kigezi was found in November to be attacked by caterpillars of *Plusia* (*Phytometra*) *orichalcea* Fabr. (Noctuidae). In 1944, the writer found this pest on plants of high nicotine content tobacco in Kigezi (Darling, 1946), but did not observe it on flax. This is the first Uganda record of *P. orichalcea* on flax. This insect is the only important pest of the crop in Kenya (Megaw, 1939) where, in the drier areas, it can cause major damage to flax grown in large continuous stands. It should not prove a serious pest under Kigezi conditions where flax is grown in small, separate plots. Its status should be carefully watched during the next few seasons.

Stored Grain Pests

Small scale tests were carried out to investigate the effect of various dusts in protecting stored maize from insect attack. The tests were started in early 1945 and continued for 15 months. Six treatments were used:—

- (1) Control—no dust.
- (2) Eucalyptus wood ash.
- (3) Kaolin—finely powdered with mean particle diameter less than 5.
- (4) Bugishu Rock Phosphate dust. Fine grade with angular crystalline particles up to 30 in diameter.
- (5) As (4) above only finer. Particles up to 20 in diameter.
- (6) Kaolin as in (3) above with 4% by weight of D.D.T. incorporated in it.

The maize used was grown on Kawanda farm in the 1944-45 season and was thoroughly sun-dried before use. Analysis by the Senior Chemist showed it to have 10% by weight of moisture at the beginning of the experiment. It was free from insect damage, but as a precautionary measure was fumigated for 48 hours with carbon bi-sulphide before treatment.

One per cent by weight of each dust was mixed with its quota of maize by shaking the two together in a closed cylindrical container for twenty minutes. About 2½ lbs. of maize were treated at a time. It was

found that the maize could not "soak up" as much as 1% by weight of these dusts. Up to a quarter of the dust remained free in each treatment and further shaking failed to make the excess stick to the maize grains.

Following treatment the grain was put into cloth mosquito-netting bags with a mesh diameter of 2 mm. Each bag held about $1\frac{1}{2}$ lbs. of grain and there was one bag per treatment. The six full bags were individually weighed and then placed in a grain store carrying a heavy infestation of *Calandra oryza* L. (Curculionidae) and other grain pests. To ensure full exposure to these pests, the bags were placed on old infested grain residues in a dark corner.

The bags were examined at intervals of not less than one month. Care was taken to disturb the grain as little as possible. Each bag was weighed at each examination. Unfortunately, the bag holding the kaolin treatment burst open after the experiment had been going four months. An unknown quantity of maize was lost. Later weighings of this treatment did not provide data valid for comparison with those of the other treatments.

During the first three months there was little sign of damage except in the untreated maize which was attacked heavily by *C. oryzae* and to a lesser extent by the Angoumis Grain Moth, *Sitotroga cereaella* Ol. (Gelechiidae). Corpses of *C. oryzae* were observed in the outer layers of all the other treatments. Many weevils had attempted to penetrate the D.D.T. treatment but had died before getting any distance in from the netting bag. The same was true in a less pronounced way of the phosphatic dust treatments. In the wood ash and Kaolin treatments quite a number of living weevils were to be observed among the maize grains but they did no appreciable damage. During the first three months the maize increased in weight by about 2%, probably owing to intake of the moisture from the air.

In the second three months pest infestation (mainly *C. oryzae*) and damage increased rapidly in the control, wood ash and kaolin treatments. The phosphatic dust and D.D.T. treatments remained free from infestation and damage.

At the end of nine months the control and wood ash treatments showed very heavy damage and the kaolin treatment was nearly as bad. The phosphatic dusts appeared to be losing their effectiveness and fairly heavy weevily infestations were developing in these treatments. Considerable damage was noticed, especially in the maize treated with the coarser phosphatic dust. The D.D.T. treatment remained untouched though surrounded by weevil corpses, hanging to the inside and outside of the netting bag.

After 15 months the control, wood ash and kaolin treatments were all so badly damaged as to make the grain unusable for human consumption. They had lost up to 27% by weight and over 95% of their grains were damaged. The phosphatic dusts were no longer in any degree effective and weevil infestations were increasing rapidly in these treatments. Damage was severe and the grain had lost up to 15% of its weight. The D.D.T. treatment still showed almost complete lack of insect infestation and damage.

In Table X are set out the results of treatment examinations after 9 and 15 months in store. The figures for incidence of grain damage were derived from five random samples each of 50 seeds taken from each treatment.

TABLE X.

Length of time in Store.		Control	Wood Ash	Kaolin	Fine Phosphate	Very fine Phosphate dust	Kaolin + 4% DDT.
9 months ..	Percentage damaged grains	84	80	72	44	26	0
	Percentage loss in weight ..	14	9	..	6	4	0
15 months ..	Percentage damaged grains	98.4	97.8	96.4	80	64	2.5
	Percentage loss in weight ..	27	18	..	15	12	0

When considering the results of this test, it must be borne in mind that—

(a) It was on a very small scale with an inadequate number of treatment replications.

(b) The treated grain was exposed to much more intense insect attack than would occur under average storage conditions.

Nevertheless the following conclusions may tentatively be drawn:—

(1) Kaolin and Eucalyptus wood ash may give a degree of protection from attack for 2-3 months. Over longer periods they may be useless.

(2) Phosphatic dusts can give effective control for at least six months (probably for much longer under average storage conditions).

(3) The D.D.T. treatment gave complete protection under very bad storage conditions for 15 months. The amount of D.D.T. used was equivalent to 1 lb. of the commercial product per ton of grain. Should D.D.T. in small quantities prove to be non-toxic to human beings and to stock, it will undoubtedly be a very efficient anti-weevil agent.

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References to Literature

- DARLING, H. S. 1946. Annual Report of Entomologist. Ann. Rept. Dept. Agric., Uganda, 1945.
- GWYNN, A. M. 1937. Studies on *Lygus simonyi* Reut. and Associated Capsids. (Unpublished manuscript).
- LIEBERMAN, F. V. 1946. Experiments with D.D.T., Sabadilla, and Pyrethrum Dusts for Control of *Lygus* spp. on Seed Alfalfa. Journ. Amer. Soc. Agron., 6, 38, p. 489.
- MEGAW, W. J. 1939. Report on the Flax Industry in Kenya. Kenya Department of Agriculture, Nairobi.
- SORENSEN, C. J. AND CARLSON, JOHN W. 1946. Insecticidal Control of *Lygus* Bugs in Alfalfa Seed Production. Journ. Amer. Soc. Agron., 6, 38, p. 495.
- TAYLOR, T. H. C. 1945 a. Recent Investigations of *Antestia* Species in Uganda. East African Agricultural Journal, 4, X, p. 223 and 1, XI, p. 47.
- 1945 b. *Lygus simonyi*, Reut., as a cotton pest in Uganda. Bull. Ent. Res., 2, 36, p. 121.

REPORT ON COTTON, KAWANDA AREA

Agriculture

A programme of husbandry research which provides fully for work to be done in Buganda has recently been prepared. Some of this work is, of course, already progressing at Kawanda, Bukalasa and elsewhere, but it will be some time before results emerge. Meanwhile there will be no further references to such subjects as rotations and interplanting in this report.

Sowing Date.—No cotton was planted on Kawanda farm until 27th June. This action was taken on Taylor's⁽¹⁾ statement that: "In the elephant-grass zone much of the *Lygus* damage would be avoided if sowing began in June instead of May." Taylor's prognosis was amply fulfilled and there was comparatively little *Lygus* damage; although it must be allowed that the unusual drought in April may have disturbed the ordinary sequence of the events. The features of the crop were:—

(a) a large crop was set from the main flowering flush in spite of the drought in September–October, *i.e.*, drought without *Lygus* did not cause shedding of the main crop;

(b) apart from a rather sharp attack of *B. malvacearum* in August–September the crop was remarkably free from diseases and pests of all kinds;

(c) picking lasted for two months only, from December to February, and picking costs were very greatly reduced;

(d) the amount of stained cotton was negligible; good harvesting weather contributed to this result, but it is fairly certain that the healthy life of the crop was the main cause;

(e) yields were remarkably level from all fields over a sowing date range from late June to early August.

The last point is illustrated by the following table, summarizing the yields of *clean* seed cotton in pounds per acre from the Kawanda 20-acre increase area for the past five seasons:—

Sowing Date.	April.	May.	June.	July.	August.	All.
1941	..	724 (6)	759 (1)	..	..	730
1942	..	969 (2)	931 (4)	724 (1)	..	926
1943	..	542 (2)	504 (3)	371 (2)	..	498
1944	177 (1)	286 (3)	796 (2)	538 (1)	..	424
1945	..	..	960 (2)	892 (3)	712 (1)	881

The figures in parenthesis are the numbers of fields, planted on different days of the month, contributing to the average. It will be seen that the yields from the June and July sowings are the highest on record. The August sown field was stony and badly eroded so that its yield can be put at rather more than its face value. A small variety trial planted on the Experiment Farm early in September yielded nearly 800 lbs. per acre. It remains to be seen whether the same general story will be repeated in other years.

(1) Taylor, T.H.C. (1945), Bull. Ent. Res., 36, 1946.

Genetics and Breeding

Owing to the heavy stainer attack in the previous season all work was very much hampered by bad germination.

Blackarm Resistance.—The transference of Blackarm resistance to BP 52 continued, but it is emphasised that it is proceeding empirically without reference to the gene or genes involved. Dr. Knight has been asked to visit Uganda to investigate this point.

Wilt Resistance.—A small trial with 18 replications (on the same lines as the one last year) was planted to test KP 28, KP 40, their F_1 and F_2 hybrids and both back-crosses. The percentages of plants which developed symptoms of wilt (after using a square root transformation) were as follows:—

			External Symptoms during growth.	Internal Symptoms when uprooted.
			%	%
KP 28	..	..	1.0	15.2
KP 40	..	..	44.7	64.1
F_1 hybrid	..	..	11.8	31.9
F_2 hybrid	..	..	13.9	42.8
Back-cross to KP 28	..	..	6.7	30.9
Back-cross to KP 40	..	..	22.3	47.5

It is plain that resistance to wilt is being inherited in a rational manner, but it is still not possible to say whether a simple or complex genetic system is at work. It remains to be seen whether the full resistance of the donor parent can be recovered by selecting segregates from a selfed back-cross population. Meanwhile the routine transference suggested by Mr. Hutchinson is continuing.

Seed Type.—The transferences described in last year's report are continuing. This subject is referred to again under the heading of maintenance.

Red Plant Body.—The transference of the gene R1 to strains with different types of plant habit is now being started systematically. The plan is to elucidate the linkages which operate and then use them to measure the adaptive advantages of different plant habits under conditions of *Lygus* and Blackarm attack. Three features of plant habit are to be considered, singly and in combination:—

- (a) semi-cluster habit as described in America;
- (b) strong development of basal monopodia;
- (c) development of subsidiary monopodia from buds which remain dormant in the normal plant.

Tomentum.—The transference was begun of tomentose hairiness from existing hybrid material (*G. tomentosum* by *G. hirsutum*) to the varieties MU 8A and BP 50, which have good normal hairiness. This is being done as a possible means of gaining resistance to *Lygus*, but no effect can be observed yet because tomentose hairiness is only fully expressed in the homozygous condition.

Okra Leaf.—This character is being transferred to the variety BP 52 to observe the effect of a more open ecoclimate on insect behaviour. Again no observations can be made until the character is recovered in the homozygous condition.

Maintenance.—This season there was a marked increase in the proportion of black seeds throughout the commercial areas of BP 52 in Buganda. It is clear that there is a considerable selection pressure in favour of this character (which derives from the old Buganda Local seed) and it is likely that it operates by differential germination. This would account for the fact that the effect is more marked in certain years. All Bulemezi received new seed in 1945 and in contrast to the experience of the previous season the access of black seeds in the new seed completely nullified the work and expense of replacement (that is, the proportion of black seeds remained the same in Bulemezi when it should have improved). Clearly if our present seed replacement scheme cannot overtake this selection pressure then it will not achieve the distribution of pure BP 52 throughout Buganda. The obvious botanical solution to this particular problem is to transfer the tufted ("black") seed type to BP 52, if this can be done without detriment to other characters. But that does not absolve our seed distribution scheme from criticism.

The special bulk of BP 52 seed made up from 150 re-examined progenies gave an excellent yield at Kawanda and realised over 900 lbs. of first quality seed. The whole of Bukalasa farm is to be planted with it this year. In this bulk semi-cluster habit and the development of basal and subsidiary monopodia were noticeably more prominent than in commercial stocks. During a visit to Ukiriguru Mr. Pearson found that this was also true of each of the 150 progenies planted there individually, under conditions quite different from those in Uganda and free of *Lygus* attack. This is interesting because it shows that the author has further emphasised these characters when re-selecting. This happened in spite of the fact that the single plant selections were made in a field badly damaged by *Lygus*, so that plant habit was hardly recognisable. These facts seem to clinch the contention that these characters have been developed empirically.

Variety Trials.—A 5 by 5 lattice square was planted at Kawanda on 17th July. The germination of several varieties was irregular and comprehensive comparisons had to be limited to characters with small environmental variation, such as ginning percentage and lint length. Restricted comparisons of other characters were possible between the few varieties which germinated normally. BP 52 as control yielded rather more than last year at 260 lbs. of clean lint per acre. The early maturing variety KP 40 ex BP 50 gave 308 lbs. per acre. Somewhat surprisingly B 181 gave 406 lbs. per acre, the highest yield of all. Examination of past records shows that B 181 is more variable in relation to season and locality than in relation to sowing date. MU 8A and some other introduced varieties succumbed to wilt and yielded very poorly.

The district variety trials were devoted to the same varieties as in the previous season, but no sowing was permitted until July or later. KP 28 and BC 6/14 germinated badly, so yield comparisons were limited to BP 52, B 181 and X 3. Bulindi trial was planted on 3rd August and yielded 402 lbs. of clean lint per acre. Kawanda trial planted on 4th September yielded 256 lbs. per acre. The three centres in Bulemezi and Singo (Kalagala, Bukalasa and Bukomero), planted in July, all yielded well over a bale an acre. Variety comparisons were of minor interest, but it is again clear that our previous conclusions about the value of early sowing are due for careful revision.

Spinning Tests.—The Shirley Institute kindly undertook spinning tests on a large number of samples from the 1944-45 season. Small scale tests

on samples from the variety trial at Kawanda showed that the spinning quality of BP 52 (count-strength product of about 2,500) has been fully recovered in the third and fourth back-crosses of Blackarm resistance. This is a most gratifying result. B 181 and its derivatives were a good deal weaker at 2,200–2,300, but derivatives of BP 50 scored about 2,400. Full scale tests on samples from the district variety trials favoured BP 52 and BC 6/14, but the latter variety is not resistant to Blackarm and has now probably lost any interest that it might have had. Some interesting locality differences came to light and a sample of BP 52 grown in Toro (from ordinary bulk seed) gave a highest standard count of 94, the highest ever recorded in Uganda.

Seed Distribution.—All seed in Bulemezi and near its borders (the heart of cotton growing in Uganda) was replaced in 1945. Fresh relatively pure seed was brought in mainly from North Kyagwe, but also from Buruli and Singo. The results have already been described. No seed replacement has been planned in 1946 outside the legally segregated areas; the abrupt increase in the proportion of the old type has left us bereft of big stocks sufficiently pure to be worth while moving further. This paralysed condition is serious and presents a very difficult problem.

The mixture X 3/38 in south Masaka suffered another bad season which undeservedly diminished its reputation. This was due to drought on an unfavourable soil type, which brought on a widespread *Alternaria* attack. It has been decided not to proceed further with the distribution of X 3/38 this year for two reasons. The transference of Blackarm resistance to BP 52 by genetic means has rendered this mixture out of date. Furthermore it is felt that the time has not yet arrived to abandon Buganda Local as a fair-sized commercial bulk from which further new material can be selected.

Plot Technique

One field of cotton and one of sweet-potatoes were harvested as uniformity trials, but it will take some time yet to complete the reduction of the results. In the meantime gully-filling, levelling, cultivation and continued care generally are bringing about an obvious improvement in the uniformity of the experimental land. So the detailed treatment of uniformity data might well be postponed until this process is still further advanced. Ploughing equipment is still a limitation, but it is hoped that it will be possible to find a one-way plough suited to Kawanda conditions.

Entomology

It has been stated in an earlier section that *Lygus* damage was light and other pests negligible.

Mycology

Blackarm and wilt have been dealt with in earlier sections. *Alternaria* and associated fungi caused quite considerable damage to cotton along the shore of Lake Victoria between Entebbe and the Tanganyika border. This condition seems to be associated with the occurrence of drought on the very acid soil (a quarternary deposit) which is found near the lake shore. The increase of X 3 seed in south Masaka was affected and also Nkozi and Kyanamukaka variety trials. Nkozi trial suffers chronically from *Alternaria*. There are indications that resting this soil under elephant grass greatly alleviates the trouble.

J. D. JAMESON,

Senior Botanist.

REPORT ON COTTON, SERERE AREA

Introduction

During the 1945-46 season breeding work was largely restricted to increasing and testing the Blackarm-resistant strains already isolated. Unfortunately it was not possible to carry this work as far as was hoped, owing to poor yields from the increase rows of the previous season. This prevented the inclusion of Blackarm-resistant strains in the district variety trials, so that no information could be gathered about the performance of these strains in various parts of the country..

All cotton suffered from the usual service shedding of squares and bolls generally attributed to *Lygus*, whilst Blackarm attack was, on the whole, more severe than usual.

Agriculture

INTERPLANTING EXPERIMENT WITH CASSAVA.

This was a repetition of the previous year's trial except that Cassava only was used for interplanting. Cotton was spaced at the usual 3 ft. by 1 ft. and the Cassava spaced at 6 ft. by 6 ft. and between the rows of cotton. Cotton was sown at the end of June and Cassava planted in the middle of August and October.

Interplanting made no detectable difference to the yield of cotton even with the earlier interplanting, which did depress yields in the previous season's trial. Although Cassava yields were not measured, the "take" was quite good and would have assured a supply of food in the middle of 1946 or later.

INTERPLANTING EXPERIMENT WITH BEANS.

In this experiment cotton was interplanted with beans and the yields of both cotton and beans compared with the corresponding yields from the crops growing by themselves. Two kinds of beans were used, Canadian Wonder and Tepary, which were sown ten days after the cotton. There were two replications, one sown in June and the other in July.

At neither of the sowing dates were any differences found between the yields of cotton when grown by itself and when interplanted. Similarly interplanting had no detectable effect on the yield of either Canadian Wonder or Tepary beans, but yields of beans were rather irregular and only fairly large differences were detectable.

N.P.K. EXPERIMENT.

Final crops of *Eleusine* millet followed by Cowpeas were grown to test the residual effects of manures applied to the cotton grown in 1944. The yields of *Eleusine* showed responses to dressings of ammonium sulphate and calcium phosphate, but Cowpeas showed no such response.

Cotton Breeding

BLACKARM RESISTANCE.

The selection of resistant genotypes being completed there remained only to test the resistant varieties in trials and to increase the more promising. As indicated in the introductory paragraph, there was a severe shortage of seed of most varieties, so that adequate testing as well as increase, was not possible. Some varieties had to be increased once again in rows with flower tying.

As a result of the Blackarm project we now have six resistant selections from N 17, six resistant selections from B 181, and a bulk mixture of resistant selections from BP 50R. These selections were compared with their parental types and other commercial varieties such as BP 52 and SP 84 in a variety trial of lattice square design. Unfortunately this trial suffered from poor germination so that yields had to be corrected for stand. The routine Blackarm lesion counts did not clearly demonstrate the resistance of the Blackarm-resistant strains compared with their parental types, although the marked resistance of B 181 and its derivative was clearly shown. The best resistant N 17 derivative gave a yield of 202 lbs. of lint to the acre as against 123 lbs. to the acre, the average for the commercial N 17 bulks. As in the previous year the highest yields came from B 181 and its derivatives, the best of which yielded 237 lbs. of lint to the acre and had a lint length greater than any of the N 17 selections as well as SP 84. The Blackarm-resistant bulk of BP 50R selections yielded 197 lbs. of lint to the acre.

DISTRICT VARIETY TRIALS.

Trials were conducted at nineteen centres throughout the district. The major varieties N 17, BP 52, BP 50 and B 181 were grown at most centres together with KP 28 (related to B 181), S 4105 (Ex N 17 M₂) and SP 84 (Ex U 4/4/2) according to locality. The results of the Blackarm lesion counts were broadly similar to last year; B 181 and KP 28 showed strong resistance everywhere, whilst BP 50R was better than the rest, and N 17 and its derivatives were distinctly more susceptible. As regards yield B 181 was highest everywhere, although SP 84 approached it at Katakwi more nearly than in recent years. BP 50R and BP 52 gave rather similar yields, somewhat lower than B 181. The salient feature though, was that N 17 was outyielded practically everywhere by the Buganda varieties BP 50R and B 181 (and KP 28), and by the Nyasaland Up-land BP 52. There was thus a rough correlation between yield and blackarm-resistance, but it cannot be said whether this disease is the yield controlling factor until Blackarm-resistant selections of N 17 are included in the district variety trials. This will be possible in the 1946/47 season.

PLANT SELECTION.

Single plants were selected on vegetative characters, mainly branching habit, in fields of KP 28 (a B 181 selection made at Kawanda) and Blackarm-resistant BP 50R, with a view to examining the progenies in the 1946/47 season.

TYPE COLLECTION.

This was discontinued apart from the maintenance of a few varieties of local interest.

SPINNING TESTS.

Samples from the 1944/45 district variety trials were bulked by localities in the usual way, four varieties being compared in north-west Uganda, Teso and Lango, and Bukedi. In the first two of these localities BP 52 gave the strongest yarns, with little difference between N 17, BP 50 R and B 181 which were weaker. In Bukedi, on the other hand, BP 52 was surpassed by B 181 in strength, the remaining two varieties giving yarns considerably weaker. On the whole B 181 was best in appearance in each locality and BP 52 poorest. Small scale spinning tests emphasised the good appearance of B 181 and N 17, but differences in strength were small.

SEED DISTRIBUTION.

The increase of B 181 in north Teso continued for the third year. The Lalle segregated area was supplied from Serere, and the total area under B 181 amounted to 16,000 acres. Since Serere supplied Lalle with B 181 it could not also supply improved N 17 destined for south Teso, thus the Mulondo segregated area supplied its own seed as well as Labori-Kadunguru. In north Mbale SG 29 was finally replaced by BP 52. The supply of S 4105 (Ex N 17 M₂) to Busoga through the seed farm at Nakabango broke down owing to contamination with seed from outside sources at the hundred acre stage.

Physiology and Entomology.⁽¹⁾

LYGUS ATTACK.

The late ripening and harvesting of the grain crops, and perhaps also the correspondingly late maturation of wild host plants, delayed the migration of *Lygus* on to cotton, so that the onset of the *Lygus* attack was delayed by as much as two months. May-sown cotton, therefore, escaped attack during the first three months of its life, and this may have accounted for the fact that some May-sown plots on the Experiment Farm yielded at the rate of over 1,000 lbs. of seed cotton to the acre.

Lygus leaf damage developed at the end of August and during September. As far as could be judged the attack was rather less severe than usual, and in support of this there was definite evidence that the *Lygus* population was below normal. A grand total of 9,000 net sweeps made in ripening *Eleusine* millet at Serere during July and August, took an average of four adult *L. simonyi* per hundred sweeps, with a maximum of eight per hundred sweeps in early August. A similar survey made by A. M. Gwynn⁽²⁾ in June of 1937, considered a normal year, gave an average of twelve adults per hundred sweeps. It is conceivable that this low population was the result of the abnormally long drought, extending through the first four months of the year, which might have reduced the number of *Lygus* adults surviving from the previous rains.

SOWING DATE TRIAL.

This was of the routine form based on contiguous plots sown at different times. The plots were sown in May, June and July. The effect of sowing date was very marked, the May sowing yielding more than four times the weight of clean lint than the July sowing. This may have been partly due to the fact that the early-sown cotton escaped attack by *Lygus* during its early stages, as indicated above. On the other hand it is not known whether it subsequently underwent an attack equally as severe as the second or third sowings, for no adequate method has been developed for assessing *Lygus* damage on cotton plants. The leaf damage counts which are done as routine at this station, are useful for comparing the extent of leaf damage on fairly similar varieties at a given age. On the other hand they are of much less use in following the attack on a group of plants from time to time, or comparing the attack on plants of different ages at the same time.

The May-sown cotton set a number of bolls on the lower sympodia, but few of these reached maturity, although the reason for this was not clear. It would seem that this loss could not have been due to *Lygus* since many of these lower bolls had grown beyond the stage at which they are considered to be susceptible to *Lygus* attack.

(1) The assistance of Mr. H. S. Darling, entomologist, is gratefully acknowledged.

(2) Unpublished manuscript.

COTTON LEAF PHYSIOLOGY.

This work followed up the attempt made in the previous season to investigate the changes occurring in cotton leaf tissue during the development and aging of the plant. Once again it was largely a study of methods.

In the 1944/45 season the leaf punch method of sampling was used, and it was found that if constituents such as dry matter or water were expressed on a sample basis (*i.e.*, an area basis), the trends in dry weight and water content were quite different. The dry matter increased as the plants developed, whereas the water content remained relatively constant. This result was difficult to interpret since variations in leaf thickness were not taken into account. During this season an attempt to overcome this difficulty has been made by not only measuring the thickness of the discs, but also the actual volume of cells in each sample, after the discs had attained full turgor by floating on water. It was found that considerable fluctuations occurred in cell volume of the samples from time to time through the season. This at once eliminated the usefulness of following trends in leaf constituents on an area basis. Even so the main results of the previous season were confirmed; when expressed on a cell volume basis it was found that the dry weight increased considerably as the plants developed, whilst the changes in water content showed relatively small changes. In addition the protein nitrogen content of the samples was estimated since it was thought that this might be a logical basis on which to express leaf hydration. The weight of protein nitrogen increased with the age of the plant in a similar way to dry weight, and seemed to have no advantage over the latter in expressing changes in leaf hydration.

As might be expected there was a close correlation between the cell volumes of samples and their water contents when fully turgid. This leads to the tentative suggestion that the water content of the fully turgid sample is a useful basis on which to express its water content as found on the plant in the field.

It was confirmed that the proportion of water to dry weight was similar for different aged leaves and even buds, found on a plant at a given time, and that this proportion fell in all the age categories investigated, as the plants developed. In other words it seems justifiable to conclude that the dry weight per unit cell volume increased in leaf tissue, including buds, as the plants developed. The inclusion of buds is important from the viewpoint of *Lygus* attack, since this insect only attacks very young developing tissues. It is possible that herein lies a clue to the greater resistance to attack of older, as compared with younger plants.

P. E. WEATHERLY,
Plant Physiologist.

REPORT ON FOOD CROPS

By THE BOTANICAL SECTION.

(A) SERERE SECTION

Eleusine

(a) OBSERVATION PLOTS.

Sixteen new introductions from Northern Rhodesia, Kenya and India, were grown side by side with five of our standard varieties for comparison. Eight of the introductions were late maturing, and of the remaining early maturing varieties, two were earlier than the standard varieties. These early types seemed to be the shortest, only attaining about twelve inches in height, and should be worth further trial.

Very great differences in germination made it impossible to assess the importance of varietal yield differences, but the new introductions seemed to be on the same footing as the standard varieties.

(b) THE NATURE OF "EKITU" (plants with wild heads).

It has been suggested that "*Ekitu*" is nothing more than *Eleusine indica* growing as a weed in a crop of *E. coracana*. Since the chromosome numbers of *E. indica* and *coracana* are very different, it is of interest to know the chromosome number of "*Ekitu*", for if it were different from that of *E. indica*, its identity with the latter would be disproved. Cambridge University kindly consented to count the chromosomes, and for this purpose suitable material has been despatched to England. As yet the results have not been received.

Setaria

The ten best varieties from previous trials were compared in randomised blocks. Yields varied between 1,000 and 1,700 lbs. to the acre (see table below), but varietal differences showed little correspondence with the previous years except that S 10 was again the heaviest yielder.

YIELD IN LBS. PER ACRE.

Variety.	Heads.	Threshing.
		%
S 1	1,498	80.7
S 3	1,026	79.0
S 4	1,401	77.4
S 5	1,283	78.8
S 6	1,573	78.8
S 7	1,469	72.7
S 8	1,377	76.9
S 9	1,430	73.2
S 10	1,774	75.4
S 12	997	74.1
Significant difference ..	340	..

Sorghum

Although the smut *Sphacelotheca sorghi* occurs to only a limited extent at Serere, varietal resistance to the disease has already been noted (see 1944 Report). It was decided, therefore to test the resistance of all the available varieties with a view to eliminating the less valuable ones.

The seed of ninety-seven varieties was dusted with spores of the smut before sowing, infection being in the seedling stage. At maturity the incidence of the disease was estimated by counting the proportion of diseased to healthy heads. In nineteen varieties there was less than ten per cent. of smutted heads whilst in twenty-nine varieties there was more than forty per cent. of smutted heads. The remaining varieties were of intermediate resistance.

The most resistant and most susceptible varieties are shown in the table below, with their corresponding yields. Germination was very patchy so the yield figures must be taken with reserve.

In addition observations were made in other characteristics such as susceptibility to bird damage, and as a result it will be possible to eliminate a number of varieties.

Variety.	% Smutted heads.	Yields lbs. per acre.	Variety.	% Smutted heads.	Yields lbs. per acre.
Resistant varieties.			Susceptible varieties.		
L 10 ..	6.3	1,568	L 1 ..	47.8	741
28 ..	8.0	3,790	19 ..	41.5	1,612
T 11 ..	9.0	1,437	20 ..	61.4	261
15 ..	5.9	1,742	26 ..	42.5	1,568
G 3 ..	9.6	1,307	33 ..	46.7	1,612
7 ..	10.0	1,176	T 9 ..	50.8	392
D 3 ..	7.2	1,220	21 ..	58.4	697
A 3 ..	9.4	1,002	H 4 ..	57.5	479
7 ..	8.7	44	5 ..	59.4	653
N 1 ..	7.7	1,568	A 2 ..	56.3	392
J 7 ..	0.9	2,047	4 ..	58.6	392
28 ..	5.6	1,568	5 ..	42.2	261
38 ..	9.8	1,655	M 1 ..	43.2	392
49 ..	4.8	1,699	3 ..	47.5	436
60 ..	0.8	566	Kawanda ..	66.7	392
SA 2 ..	3.3	218	Wheatland ..	60.8	131
5 ..	7.1	131	Sakwa ..	40.8	741
7 ..	3.1	87	J 1 ..	50.3	1,133
Kabi ..	7.0	1,263	6 ..	41.6	784
			13 ..	43.0	348
			14 ..	50.6	436
			15 ..	37.5	566
			22 ..	44.7	741
			51 ..	55.2	1,481
			57 ..	55.8	566
			58 ..	40.0	958
			59 ..	40.0	915
			65 ..	48.5	566
			SA 1 ..	42.7	218
			6 ..	72.7	87

Pennisetum

Two varieties from Ukiriguru in Tanganyika, called "Native" and "Indian long" completely failed to germinate.

Groundnuts

Fourteen varieties were compared in randomised blocks. Seven were of local origin and the remainder introductions and selections. The trial was sown in early May which would be considered too late in a normal year. The results are given in the table below:—

Varieties.	Rosette percentage.	lbs. per acre unshelled.	Shelling %
Atuboi	1.8	955	64.9
Bulindi	3.5	1,453	64.1
Mubende	3.0	1,372	63.0
B. 353	1.4	1,411	65.9
BB. 2	1.5	1,436	65.1
S. 183	3.4	851	69.4
Loc. spreading ..	7.8	778	62.9
B. 239	0.8	1,569	61.8
West Nile	0.7	1,689	62.9
S. 185	5.1	899	64.5
B. 713	1.0	1,480	65.5
Busoga	2.9	1,337	66.1
Teso	1.3	1,342	63.6
S. 721	2.7	1,390	69.1
Significant difference ..	3.5	229	..

It will be seen that although sowing was late yields were well up to average, whereas sowing date trials in the past have shown that May sowings normally give very poor yields. This is very likely due to the low incidence of rosette disease which this trial suffered. In 1944 the May sowing showed an average of fifty-four per cent. rosette. This difference may be related to a possible unusual distribution of white fly caused by the abnormalities of the season. Also it is possible that late sown plots of groundnuts in sowing date trials suffer unduly from rosette owing to the proximity of early sowings from which migration of mosaic bearing white fly might occur.

As regards varietal differences West Nile local variety and B. 239 were again heavy yielders, whilst *Atuboi*, Local spreading, and the two selections S. 183 and S. 185 were less than average in yield. There was little difference between the remainder, and no detectable differences in shelling percentage.

Soya beans

On 27th April ten varieties of Soya beans were sown in randomised blocks. Conditions at sowing seemed favourable, and rain was plentiful during May. Nevertheless germination was very poor and subsequent growth patchy. For this reason the yields which are given in the table

below are difficult to interpret, but the Nigerian variety Ootoon was outstanding in germination and yield.

Variety.				Germination. %	Yield of shelled beans in lbs./acre.
H	6	..	..	31.6	235
H	18	..	..	20.7	159
H	29	..	..	33.1	185
H	36	..	..	23.5	123
H	49	..	..	29.2	218
R	184	..	..	19.5	100
S	42	..	..	26.5	261
S	256	..	..	25.7	102
S	263	..	..	24.2	97
O	tootan	..	..	56.3	441
Significant difference..				..	71

Beans (*Phaseolus* spp.)

Five varieties of beans which had grown well in the introduction area in previous seasons, were compared in a latin-square layout. The trial was sown on 18th May, but in spite of this late sowing the plants suffered heavily from insect attack, and yields were poor.

Variety.	K23	Canadian Wonder.	Abun- dance.	K 4	White Haricot.
Yield in lbs. per acre	309	361	461	427	309
Significant difference	..	..	107	..	..

It will be seen from the yield figures given above that Abundance and K 4 gave better yields than K 23 and white haricot whilst Canadian Wonder was intermediate.

Cowpeas

(a) The 1944 combined sowing date, spacing, variety trial was repeated except that the low yielding variety 55 was replaced by tepary bean.

No significant differences were found between sowing dates or varieties, though there were significant differential responses of varieties to sowing date and spacing. (See tables below).

SOWING DATES × VARIETIES.

				July 31st	August 21st	September 11th
T.	Beans.	..	..	471	346	467
S.	6	..	..	385	210	431
S.	13	..	..	210	223	497
S.	12	..	..	264	268	290
S.	9A	..	..	146	187	575
Least Significant difference				..	219	..

VARIETIES $\times$ SPACINGS. LBS. PER ACRE.

				1' $\times$ 1'	2' $\times$ 1'
T.	Beans	..	..	662	479
S	6	..	..	360	552
S	13	..	..	243	584
S	12	..	..	335	574
S	9A	..	..	265	542
Least significant difference				165	
Spacing Means ..				373	546
L.S.D. ..				62	

It will be seen that whilst the varieties S 12, S 13 and S 9A gave significantly poorer yields from early sowing, Tepary bean showed no response to sowing date and S 6 gave a poor yield at the middle sowing date. The effect of spacing is clear cut; Tepary beans gave a bigger yield at the 1 ft. by 1 ft. spacing, and the cowpeas did better at the 2 ft. by 1 ft. spacing, confirming last year's result.

(b) DEFOLIATION TRIAL.

A simple trial was carried out to see whether the native practice of defoliation has any marked effect on yield. Defoliation was started five weeks after sowing and was continued at fortnightly intervals (three times in all). On each occasion almost half the leaves were removed. Yields reflected a slight increase of yield with defoliation but the difference was not statistically significant.

Sweet potatoes

The variety and sowing date trial designed to test maturity period and underground keeping qualities, is still in progress.

Cassava

(a) Testing of resistant clones for maturity period and underground keeping qualities, in progress.

(b) Routine testing of seedling and clonal material from Amani, in progress.

(B) KAWANDA SECTION**Eleusine**

A variety trial was planted on 29th March to compare the five standard varieties from Serere with local Buganda seed. Should *Eleusine* cultivation be taken up to any extent in this area it would probably be worth while to do further tests with Serere seed.

YIELD: LBS. PER ACRE (unthreshed).

Buganda	..	..	2,819
Engenyi	..	..	3,194
Engomu	..	..	2,602
Emoru..	..	..	3,013
Emiroit	..	..	2,916
Ekwakoit	..	..	3,158

Significant Difference .. 278

Setaria

Setaria was grown in bulk on several fields. It is a handy quick crop for covering land at odd times of the year and leaves a good stubble mulch which is useful in the dry season. The potential yield of grain is enormous, but the depredations of birds are heavy.

Groundnuts

A variety trial was planted on 3rd April to see whether Serere material compared favourably with local seed.

YIELD: LBS. PER ACRE (unshelled).

				12" × 12"	12" × 6"	Both Spacings.
Bukalasa Bunch	..	..	..	616	1,366	991
Atuboi	..	..	..	792	1,874	1,333
B 227	..	..	..	891	1,715	1,303
B 239	..	..	..	919	1,840	1,379
S 185	..	..	..	280	899	589
Spacing Means	..	..	..	670	1,539	1,119
Significant Difference (varieties)	..	..	..	226	317	184

The trial encountered dry weather after planting and the stand was not good. Rosette disease was severe on the wider spaced plots, emphasising the need to establish a good close cover on the ground. Taking this trial in conjunction with previous ones it would seem that B 227, which is a good bold Virginia type nut and popular with Africans at Kawanda, would be worth releasing for trial by growers in Buganda.

Soya Beans

Experimental work with this crop makes such big demands on our limited drying facilities that it was necessary to restrict the programme considerably. A variety trial comprising 25 varieties was planted in two sections (to spread the rush on drying and threshing space) on 23rd April and 7th May. One of the main objects of this trial was to cut down the large amount of material in hand. The crop was not very good,

Briefly the Hernon varieties from Southern Rhodesia made up the first group for yield; the *Potchefstroom* varieties (with R 184 as control) made up an intermediate group; whilst the more recent introductions from America yielded very badly.

YIELD: LBS. PER ACRE.

Hernon.		Potchefstroom.		American.	
H 5	.. 685	R 184	.. 516	Clemson	.. 456
H 29	.. 788	S 42	.. 682	Bansei	.. 425
H 36	.. 542	34.S 273	.. 350	Willomi	.. 360
H 49	.. 739	34.S 304	.. 695	Imperial	.. 360
		35.S 263	.. 700	Jogum	.. 288
		34.S 395	.. 607	Seminole	.. 417
		38.S 5	.. 513	Wilson Ely	
				Black	.. 534
		39.S 11	.. 697	Virginia	.. 420
		41.S 77	.. 604	Dunfield	.. 547
		42.S 2	.. 679	Scioto	.. 454
				Macoupin	.. 651

Significant Difference .. 187

The Hernon varieties were also grown with R 194 as control in simple observation plots at four outlying centres. The yield of H 29 was unfortunately prejudiced by poor germination.

YIELD: LBS. PER ACRE.

	Kyembogo	Kakumiro	Bushenyi	Bulindi	Mean.
Local	.. 762	..	..	..	..
R 184	.. 1,149	1,830	1,285	937	1,300
H 5	.. 1,394	1,699	1,197	784	1,269
H 29	.. 1,263	1,307	980	980	1,133
H 36	.. 1,416	1,525	1,219	958	1,280
H 49	.. 1,568	1,917	1,219	958	1,416

Potatoes (*Solanum*)

Stocks have been kept going through the year in maintenance plots, but there have been no really good yields this season.

YIELD: TONS FRESH TUBERS PER ACRE.

Planted.	December (1944).	April-May	October.	November.
Blue..	.. 0.4	0.4	1.6	0.8
Nyeri	.. 0.4	2.0	1.8	1.3
Nanyuki 3	.. 0.1	1.5	1.6	0.7
Roode Star		2.5	1.6	1.0

In addition a field of 5/8ths acre was planted up in June with mixed seed (of discarded stocks) which happened to have sprouted well in the store. It yielded at the rate of 3 tons to the acre in spite of the fact that this was the only field on which blight (*Phytophthora*) has been appreciable in the last two seasons.

Potatoes (*Ipomoea*)

The work in connection with the suspected virus disease is in the hands of the Senior Plant Pathologist.

A bulk field was planted up with four varieties which yielded as follows (tons per acre):—

Namujuna	..	..	10·25
Gafemulago	..	..	10·24
Kaungezi	..	..	7·11
Kitikyambazi	..	..	6·44

The first two varieties are popular, and large numbers of cuttings have been taken by farm personnel and their friends.

Cassava

Stocks of the mosaic-resistant varieties were maintained and several lorry loads of cuttings were sent away in August to various distributing centres in Buganda.

Yams

Another crop was raised from the collection and sampled for flavour by Africans and by my own family. *Ulakai Valli* and *Madevu* had by far the best flavour and texture and were among the four best yielders (about 9 lbs. per plant).

Bananas

A start was made to plant up a large area with clonal material of different varieties for general observational purposes. One of the first purposes of this banana garden is to gain experience in the planting and cultivation of the crop.

REPORT ON EXPERIMENTAL WORK IN BUGANDA

Bukalasa—General

Bukalasa continued to suffer from a shortage of labour throughout the year and the labour also do very poor tasks. The Rural Assistants' course continued over the whole period of this report. Ten out of the twelve Rural Assistants' houses in the Crescent were completed, five by the Rural Assistants and farm labour and five by contract. Other buildings completed included a second pig shed in sun-dried brick and a cob cattle kraal on Holding D. The making of Roman tiles on a small scale was restarted early in 1946.

The erection by the P.W.D. of buildings for the ex-soldiers' agricultural courses at Bukalasa commenced during the second half of 1945. These buildings, which comprise two permanent dormitories, a dining room, recreation room, kitchen, ration store, and several staff houses as well as two temporary dormitories and some rondavels for labour, have enormously expanded the accommodation at Bukalasa and will be of great permanent value to the station whatever types of courses may be held there after the training of ex-soldiers is completed.

Two additional bore-holes were sunk on the station by the Geological Survey Department, one near the Crescent and one near the ex-soldiers' buildings. Arrangements were completed by December, 1945 for the station to take over 51 acres of Crown Land on the northern boundary of the farm, giving access to the swamp on that side and therefore better malaria control as well as providing an opportunity to demonstrate soil conservation methods on land in occupation by cultivators.

Rainfall for the 12 months was 46.06 inches against the 16-year average of 49.58. The first rains of 1945 were very late and the period December, 1945 to March, 1946 was also exceptionally dry.

Unfortunately a complete statistical analysis of the experimental results at Bukalasa this year has not been possible. The figures given in the following sections are therefore only to be taken as indications

Block E—Cotton Manurial Experiment

This experiment was in its seventh cycle of cropping, and no analysis of results is called for this year as it is in the middle of a cycle. The disadvantages of a structureless over-cultivated soil were well shown this year by the puddling following heavy rain, which led to a bad attack of *Rhizoctonia* on the cotton and necessitated complete re-planting.

Block S1—Fertility Experiment

In this experiment the treatments consist of cropping and resting cycles of varying length and therefore no direct comparisons can be made at this stage except in the plots which are cropped for three years, between three years resting under planted elephant grass and three years resting under natural regeneration. Examination of the total crop yields over the first 11 years of the experiment under these two treatments reveals only a very slight difference in favour of the elephant grass for groundnuts and in favour of the natural regeneration for cotton and beans, which is obviously not statistically significant.

Block G1—Coffee Shade and Ground Treatment

As agreed, this experiment has been abandoned and only one block is being kept on as a museum piece.

Block N2—Coffee Shade, Ground Treatment, and Manure

In this experiment, *Ficus* is still in process of replacing *Gliricidia* as a shade tree. It is doubtful how far the full effect of shade trees is in any case shown in these small interspersed plots where the trees act as wind-breaks for both shaded and unshaded plots. The annual *Stizolobium* cover has become almost impossible to establish in the mature coffee. Furthermore all the plots have for long periods been under a heavy weed cover in recent years owing to shortage of labour. For all these reasons the results from this experiment lose much of their value.

The experiment continues to show a marked triennial bearing tendency, with heavy yields this season after two preceding poor years. The treatment yields for the 1945–46 season were:—

Treatment.	Yield. lbs. cherry.
Shade	42,865
No shade	44,311
Clean weeded	22,647
Half mulch	22,574
October–March cover crop	22,084
Full mulch	19,886
Cotton seed manure	47,725
No manure	39,466

Block N1—Coffee Observation Plots

The plots which were supposed to be shaded by *Albizia* and *Erythrina* trees have been abandoned because of the poor stand of the trees. With the Robusta coffee, “No Shade” gave the highest yield this season and the difference was big enough to reverse the order of total yields for all seasons to date of that treatment and *Ficus* shade.

The yields in pounds of cherry were:—

1945–1946 SEASON.

Type of Shade.	Robusta Coffee.	Nganda Coffee.
No Shade	3,334	2,295
Natural Shade (Acacia)	3,173	1,416
Ficus Shade	2,206	1,443
Leucaena glauca shade	1,883	2,926

Totals 1937–1946 Seasons.

No Shade	20,107	9,094
Ficus Shade	19,285	7,869
Natural Shade (Acacia)	16,203	5,051
Leucaena glauca shade	14,208	9,170

Block G—Method of Cropping Observation Plots

Strips 1 and 2, continuous cropping without and with manure respectively, have completed 3 years cropping and preparations are being made for opening up the other 3 plots, of which number 5 is being heavily grazed to try and reduce the cost of digging out the elephant grass. Careful costings are being kept of the labour used on these plots.

Holding E

As this land has been under continuous cultivation for 18 years and as the plots are now being sub-divided to work in other treatments, a summary of the yields to-date may be of interest:—

YIELDS IN POUNDS PER ACRE, 1928–1946.

Season.	Maize in Cob.	Groundnuts in Pod.	Seed Cotton.
1928–1929	900	60	615
1929–1930	2,623	..	608
1930–1931	3,000	1,035	380
1931–1932	..	378	200
1932–1933	2,500	338	414
1933–1934	821	726	305
1934–1935	1,042	1,090	566
1935–1936	1,680	1,822	433
1936–1937	740	1,616	306
1937–1938	650	890	368
1938–1939	1,172	1,098	740*
1939–1940	1,080	638	850
1940–1941	638	740	715
1941–1942	1,358	1,122	427
1942–1943	1,030	1,440	715
1943–1944	1,274	200	208
1944–1945	2,030	562	639
1945–1946	1,238	864	309
Totals	23,776	14,619	8,798
Means	1,399	860	489

* Cotton spacing changed from $4' \times 1\frac{1}{2}'$ to $3' \times 1'$ in 1938.

It is evident that the overworked soil in these plots can only carry reasonable crops when the weather conditions are ideal, and that the effect of unfavourable weather is much greater on these plots than on the remainder of the farm.

Holdings C and D

Two systems of farming are being tested on these holdings. On C, cattle are stall fed and the manure applied to plantains and coffee. On D, cattle are paddocked on the resting strips. Each holding started with six oxen, but the number may have to be reduced on D. On C, elephant grass is cut from the resting land for feeding at 50 lbs. per day per ox, and even during the exceptionally dry weather of December to March, ample was available from the three acres resting.

Banana weevil damage continued to be very bad, and normal control measures failed to help much. Trapping was therefore resorted to from December, using: (1) High stump traps (stumps about 18 inches high

surrounded by pieces of stem); (2) Split stems lying on the ground; (3) Ground level stumps covered with short pieces of split stem. The first two caught comparatively few weevils and have been abandoned. The third type catches about one weevil per trap per day, and continues in use.

Kavirondo Perennial Sorghum

This sorghum was planted late in 1944 on a piece of exhausted land on the old Holding B, to test its value as a soil regenerator for the resting period. A thick stand free from weeds was originally obtained but by 1946 the sorghum had succumbed to weed competition, only isolated stools remaining amongst a mass of miscellaneous weeds. This seems fairly conclusive evidence of its unsuitability in Buganda for the purpose desired.

Livestock

Three heifers were added to the milking herd, and four working oxen were transferred to the farm from Kampala township. Six calves were born, of which one died of East Coast Fever and one of redwater. Milk records were kept but there were no outstanding results, the best lactation being only 912 lbs. in seven months (plus milk taken by the calf).

The herd of large white pigs for breeding and district sale was maintained but these pigs suffer from sun-scald and are gradually being replaced by large blacks. 32 pigs were sold, mainly to selected cultivators for breeding purposes.

The sheep flock was maintained for meat supplies to students, etc., and to keep down grass in the station. At the end of the year there were 43 animals in the flock.

The poultry flock was augmented by purchases of breeding pens of Rhode Island Reds and White Leghorns from Kenya in order to meet the demand for young stock expected from the ex-soldiers' courses. The old Light Sussex fowls and their crosses by Australorps and Rhode Islands, which have not proved particularly useful, were gradually sold off.

Kakumiro Farm

Rainfall was 43.67 inches. The tea seed plot was maintained but no seed was called for during the year. Large quantities of seed were supplied from the cinchona plot to the new experiment station in Toro. The observation plot of Nganda coffee was in its third year and yielded 588 lbs. "kiboko" per acre; there is a 4 ft. strip of elephant grass after every second row of coffee, and this yielded adequate mulch for the plot but appeared to have a bad competitive effect, while the *Ficus* shade at 24 ft. by 24 ft. also appears too close. Seed of various sorts of citrus from the farm was supplied to district nurseries. Firewood and poles from the large area of secondary forest was supplied free to chiefs and schools.

A number of crop observation plots, mainly to test good varieties from other districts against Mubende District varieties, were planted, and yields from the spring-sown crops of 1945 were as follows:—

Crop.	Variety.	Lbs. per acre.
Soya Beans ..	67 ..	1,307
	R. 184 ..	1,830
	68 ..	1,525
	63 ..	1,699
	69 ..	1,917

Crop.	Variety.	Lbs. per acre.
Groundnuts	Local ..	2,126 unshelled.
	Atuboi ..	2,126 unshelled.
	B. 227 ..	2,544 unshelled.
Simsim	Local ..	331
	Kamod ..	175
Eleusine Millet ..	Emiroit ..	639
	Engomu ..	639
	Ekwakoit ..	1,859
	Emoru ..	1,336
	Engenyi ..	1,859
Sorghum	Local ..	1,859
	Local 1 ..	1,708
	Local 2 ..	3,311
	L/1 ..	3,136
Beans	Kimwanyi ..	205
	Nakera ..	196
	Mutike ..	215
	Namunye ..	185
	Bujuni ..	165
	Haricot bean	215

Identical trials were repeated in the autumn rains, when the results were broadly similar but with much lower yields of all crops.

An observation plot of 34 local types of sweet potatoes was maintained to see if there was any differential resistance to the "virus" disease. All varieties had a mild attack of the virus. 13,785 cuttings of mosaic-resistant varieties of cassava were distributed from this farm.

Mengo District—Miscellaneous

The coffee observation plots at Mukono yielded as follows:—

	Lbs. cherry per acre.
Nganda shaded ..	7,452
Nganda unshaded ..	3,945
Robusta shaded ..	6,736
Robusta unshaded ..	5,125

From next season onwards only the Nganda shaded plot is being retained as a demonstration, and this is being thinned and the *Gliricidia* shade replaced by *Ficus*.

Yields from the plantain spacing and observation plots at Ntenjeru were as follows:—

	Lbs. green bunches per acre.
9 ft. × 9 ft. ..	18,324
12 ft. × 12 ft. ..	25,310
15 ft. × 15 ft. ..	20,748

A small trial of *Dodonea viscosa* as a nurse crop for trees was laid out at Nsangi. Three planting methods were tried; (1) seeding on bare ground; (2) seeding between grass tufts; (3) seedlings on bare ground. The third was

the most successful, but the second also gave some survivals and is being extended over a large area. The small portion of worn-out plantain garden at Nsangi which was "regenerated" in 1944-45 by uprooting and re-planting plantains in individually—dug pits gave good results and shows that this is a practical method.

Masaka District—Late-sown Cotton

For many years the question has been discussed as to whether cotton sown around the end of the year in Masaka district would not do better than at the present planting time. This year it was decided to treat the ordinary commercial cotton crop of Kabula county as an experiment, and accordingly planting (of B.P. 52 cotton) was carried out in this county from mid-October, 1945 to January, 1946. A guarantee was given that if any grower's yield was below 300 lbs. per acre due to this experiment, a sum in compensation would be added to the price received sufficient to make up the total remuneration to the value of 300 lbs. cotton per acre. 88% of the acreage was planted in the first two months; from December there was little rain. Germination of all sowings except those made from mid-December onwards was excellent. The condition of the crop appeared promising up to early January, but subsequently the season was very adverse with far too little rain for the crop. In the late-planted plots many plants died and few attained a height of more than 8 inches. Marketing took place from 20th May to 14th June, and the figures are included in this report to present a complete picture of this experiment. Only in a few plots in the south were yields over 300 lbs. per acre obtained. The average yield per acre was 168 lbs. of seed cotton from 254 acres. The sum paid out in compensation was Shs. 7,484/09.

The failure of this experiment in an unlucky season in an area always marginal for cotton-growing need not necessarily condemn the practice of late sowing of cotton in Masaka District, and further small-scale experiments are being conducted to obtain more information.

It is interesting that Mr. Manning of the Empire Cotton Growing Corporation commented on the Kabula crop that there was a conspicuous absence of *Lygus* and little Blackarm, and that though the plants were small the cropping was predominantly sympodial.

G. B. MASEFIELD,
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REPORT ON EXPERIMENTAL WORK IN THE EASTERN PROVINCE

1. Arabica Coffee

(a) 1932 PLANTED CULTURAL EXPERIMENT.

Maintained prior to final writing up.

(b) 1932 PLANTED PRUNING AND SPACING EXPERIMENT.

Yields in cwts of fresh cherry per acre:—

1945.			8'×8'	7'×7'	6'×6'	4'×4'
Unlimited Terminal Growth	..	..	71·79	84·77	78·21	82·17
Modified Multiple Stem	..	..	28·22	40·60	53·01	52·80
Totals to date.						
Unlimited Terminal Growth	..	..	413·70	406·38	462·41	603·99
Modified Multiple Stem	..	..	388·92	440·35	416·96	434·84

Unlimited terminal growth continues to give considerably bigger yields than modified multiple stem. In a small test of the amount of labour employed in picking, approximately twice as much was needed for the unlimited terminal growth as for the modified multiple stem but it will be seen that the crop on the former was twice as big as that on the latter.

Samples of all treatments were sent to Nairobi for liquoring tests; the report grouped the samples according to value as follows:—

Shs. 105/	..	..	U.T.G.	7'×7'
			M.M.S.	4'×4'.
Shs. 99 to Shs. 100	..	..	M.M.S.	8'×8'
			M.M.S.	7'×7'
			U.T.G.	6'×6'.
Shs. 96 to Shs. 97	..	..	U.T.G.	8'×8'
			M.M.S.	6'×6'
			U.T.G.	4'×4'.

There was no indication that insect damaged beans or undergrade were more plentiful in the U.T.G. and close spacing than in other treatments.

(c) 1936 PLANTED SPACING STUMPING AND UPROOTING EXPERIMENT.

Yields in cwts. of fresh cherry per acre:—

1945.		3'×3'	4'×3'9"	5'×5'
Uproot alternate rows	..	21·75	17·68	7·80
Stump alternate rows	..	8·53	12·89	10·17
Totals to date.				
Uproot alternate rows	..	217·10	187·63	213·53
Stump alternate rows	..	200·98	227·46	208·55

Alternate rows were stumped in the 4 ft. by 3 ft. 9 in. plots and in the 3 ft. by 3 ft. plots in March, 1946, making the second stumping for these lines, and the fourth for the plots. The 5 ft. by 5 ft. plots have been stumped twice, that is once for each line. Routine pruning was done on the uprooted plots.

(d) 1941 PLANTED SHADE AND MULCH TRIAL.

Yields in cwts. of fresh cherry per acre are:—

			1945.	Total to date.
Shade and Mulch ..	Cordia ..	32.46	54.95	
	Croton ..	9.16	26.26	
	Ficus ..	6.65	25.14	
	Total ..	48.27	106.35	
Shade and no Mulch ..	Cordia ..	44.08	88.45	
	Croton ..	31.01	63.04	
	Ficus ..	30.72	64.21	
	Total ..	105.81	215.70	
Mulch and no Shade ..	A.	8.44	46.73	
	B.	16.00	51.13	
	C.	13.52	31.90	
	Total ..	37.96	129.76	

The *Ficus* shade now appears to be spreading out rather more, while the *Croton* is having a less deleterious effect than formerly. Weed growth in the unshaded mulched plots has been somewhat difficult to control.

(e) MISCELLANEOUS.

Trials with washbreaks—*Coleus*, vetiver, hairless elephant grass, *Paspalum* and *Alternanthera* were continued: all are satisfactory but are not subject to soil wash to any extent.

A small trial has been started in the Kents Increase plots to see whether it is possible to allow weeds to grow in the autumn and slash the weeds for mulch at the beginning of the dry season without harming the trees. The periods of cessation of weeding are mid-September, mid-October and mid-November.

2. Food Crops

DISTRICT TRIALS (PLANT INTRODUCTION CENTRES, ETC.)

Setaria.

Grown at 5 centres in Teso.	Yields 500–2,500 lbs. per acre.
Grown at 3 centres in Mbale.	Yields 500–2,000 lbs. per acre.
Grown at 3 centres in Busoga.	Yields 400–1,850 lbs. per acre.

Not particularly popular anywhere though the Agricultural Officer, Teso, considers that the crop has possibilities on poorer soils with erratic rainfall. The Busoga Prison farms are also growing this crop as grinding is not required.

Bulrush Millet.—Grown at three centres in Amuria and Kaberamaido. Yields 180–480 lbs. per annum. Becoming increasingly popular in Teso where it does reasonably well in the autumn rains. Yields at three centres in Mbale were 150 to 870 lbs. per acre but there was no particular interest in this crop.

Tepary Bean.

4 Teso centres.	400–600 lbs. per acre.
2 Mbale centres.	300–500 lbs. per acre.
6 Busoga centres.	100–800 lbs. per acre.

Poor yields in many cases can be attributed to too early sowing. This crop has now been grown throughout the Province for a sufficient number of years to show that it is not likely to become very popular though it is just possible that it may find a place as an autumn sown crop, or interplanted crop in some of the drier areas.

Ordinary Beans.—Trials were made with White Haricot, Abundance (Masindi Brown), Canadian Wonder, and White Kidney in Teso. These beans aroused considerable interest.

In Mbale and Busoga trials at various centres took place in the spring and autumn. Yields, in lbs. per acre are as follows (Spring-planted crops):—

	Abundance.	Bukalasa.	Haricot	Canadian Wonder	White Kidney	Mutike 4.	Victory
MBALE.							
Budaka	590	270	440	170	620	..	..
Kibale	200	..	152	148	152	..	..
Kisoko	failed	..	..	failed	failed	..	..
Bududa	1,180	..	980	363	181	302	121
Bukiiti	130	370	..	320	480	740	430
BUSOGA.							
Nawanzu	635	..	759	389	341	..	..

In most cases these beans were reasonably popular, though the order of preference varies from place to place. Yields are comparable by centres as different varieties were sown on the same day at each centre.

Bukalasa has given low yields in these trials, which agrees with Kawanda results, but this variety is grown because of its high palatability.

Abundance has given relatively high yields at most centres.

Yields of White Haricot and White Kidney at some centres are higher than might have been anticipated. Perhaps these beans will do better under relatively favourable conditions than they have at Serere.

Yields (in lbs. per acre) in the autumn rains in Mbale were as follows:—

	Abundance.	Canadian Wonder	White Kidney	Haricot	Victory	Mutike 4.	Bukalasa.
Bugusege	363	145	121	..	168	..	147
Bududa	161	65	185	..	342	282	failed
Budaka	350	370	390	450	..	..	..

There is no indication if any particular planting month (spring or autumn) is best for all varieties at all centres. Abundance is less attacked by leaf eating beetles than other varieties.

Groundnuts. Sowing Date Trials.

TESO. ATUBOI VARIETY. YIELD (unshelled nuts) per acre.

Sowing Date.	Kuju.	Katakwi.	Kaberaimaido.
15-3-45	1,100	660	619
31-3-45 .. .	1,230	1,100	1,037
14-4-45 .. .	1,250	1,190	1,046

BUSOGA.

Sowing Date.	Nakabango.	Nawanzu.
27-3-45	1,007	..
26-3-45	..	653
10-4-45	987	..
16-4-45	..	689
24-4-45	145	..
30-4-45	..	176

These trials were conducted to follow up recent Serere results which have shown that, over a course of years March sowings give much higher yields than later ones. Results were partially masked by very poor rainfall in March, 1945, but the results at Teso centres are very interesting. The trials are being repeated.

Cassava.—Work was confined to increase of mosaic resistant strains. These included Bitamisi as well as six new strains from Serere. In Mbale increase was confined to increase centres. In Busoga the new varieties were grown at increase centres, but about 70 acres of Bitamisi were grown at gombolola and other centres. In Teso gombolola increase of some of the new varieties was started.

MISCELLANEOUS VEGETABLES, ETC.

Peas.—Popular wherever grown but yields were in most cases low. Harrison's Glory and Dutch Marrowfat were included.

Indian Kale.—Grown at many centres and is becoming increasingly popular.

Chinese Cabbage.—Did not prove popular.

Pumpkin.—These Amani varieties grew well wherever grown. Popularity varied.

Tsama Melon.—Grew quite well at some centres. Tried as cattle feed at Katakwe, but the cattle did not eat them. Popular at some centres in Mbale but not in Teso.

Egg Plant.—Grew well at most centres and is fairly popular.

Early Benares Cauliflower.—Grown at five centres in Mbale and grew fairly well. Some seed was collected at Bugusege.

Pineapples.—Improved varieties were introduced at four centres in Mbale.

Soya Beans.—In South Busoga the “local” variety (probably mostly Venezuelan) was grown at four centres and gave yields of between 400 and 900 lbs. per acre. In view of poor stands obtained at most centres yields were surprisingly high.

In Mbale in the spring a record yield of 2,600 lbs. per acre was obtained at Budaka and 250 lbs. and 490 lbs. respectively at Kibale and Kisoko. This again was the local variety. Autumn planting at Budaka yielded 710 lbs. per acre.

RICE.

Mbale.—Transplanted *versus* broadcast trials with four varieties.

YIELDS IN LBS. PADDY PER ACRE.

Centre.		Afaa.	Senna.	Bungalla.	Mbuya.
Nagongera	Transplanted ..	1,870	1,180	3,200	2,120
	Broadcast ..	2,060	1,720	1,380	1,270
Mulanda	Transplanted ..	2,380	1,870	2,060	2,600
	Broadcast ..	4,480	4,250	..	2,870
Bulangira	Transplanted ..	1,654	1,613	1,573	1,548
	Broadcast ..	390	520	470	420

Results were inconsistent.

Increase plots were grown at 27 centres in Busoga. Some were transplanted and some broadcast. Numerous varieties were in use. The only consistent result was that good crops were obtained wherever there was sufficient water irrespective of the method of growing; in no case were reasonable yields obtained in the absence of plenty of water.

Arrowroot.—Grew fairly well at three Mbale centres and one in Busoga. In Mbale it was found to grow better from suckers than from Rhizomes. Tubers can be dried satisfactorily only in the height of the dry season.

Sorghum.—Serere varieties were grown at five centres in Busoga, at one of which there was a fairly keen demand for seed, and for beer making.

Sim-sim.—Yields at two Busoga centres were very low.

Paw-paw.—An Amani high level variety grown at two centres in Bugishu has proved popular.

3. Coffee Robusta

Demonstration plots of Nganda and Robusta shaded and unshaded were maintained in Busoga; no conclusions can be drawn from the results to date.

4. Karamoja District

The following table shows the yields obtained from small plots at the various introduction centres. The measurements of the plots and in certain

instances the weighing of the produce also was left to the African staff so the actual figures of yields are given merely as a guide to what may be achieved in future; at Kangole where the yields were high the standing crops looked extremely well and considerably better than elsewhere.

YIELDS IN LBS. PER ACRE.

Crop.	Kangole	Natakwi	Kotido	Alerek (Labwe)	Kaabong	Remarks.
Groundnuts	1,379	..	871	578	1,210	Yields in shell.
Maize	1,114	..	f.	f	1,210	Yields in cob. f= failure.
Bulrush millet (Acholi)	268	f	..	66	444	Yields at Kotido not available. Lbs. grain.
Eleusine (mixed) ..	668	289	..	..	1,484	Lbs. grain.
Tepary	712	246	320	44	72	Lbs. beans.
Abundance	771	168	f	..	484	Lbs. beans.
Setaria No. 7	699	f	f	152	395	Lbs. grain. f= failure.
Simsim (Kumam) ..	116	f	f	76	f	f= failure.
Tepary	978	..	..	..	..	A second crop grown at Kangole.
Tepary	367	..	..	..	..	A late crop, planted 15th August, at Kangole.
Cicer arietinum ..	45	f	f	180	?	Growing well at Kaabong, but planted late.
Sorghum	..	..	..	..	..	

Alerek = Loyoroit.

Owing to house building operations and preliminary labour difficulties the crops were not all sown at the most opportune time, but given favourable conditions very fair crops can be expected at Kangole, Alerek and Kaabong. The bean and groundnut crop at Kangole are noteworthy, although it must be emphasised that the crops were grown on very small plots. At Alerek and Kaabong the growth of "chick pea" *Cicer arietinum* was very promising but the spacing was too wide and further trials will be made at a higher seed rate.

Indian Kale flourished at Kangole and Alerek.

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REPORT ON EXPERIMENTAL WORK IN THE WESTERN PROVINCE

1. Coffee Arabica

(a) *Variety and Shade Observation Plots*.—These were maintained at centres in Ankole, Kigezi and Kyembogo Farm. These were planted in 1941. The plots consist of 12 varieties with and without shade.

There were no results yet from Kigezi; but at all centres there are indications that the shade is beneficial; the leaves and shoots in the unshaded sections showing the effect of hot and cold disease. *Erythrina* and Fig shade are being used in Kigezi and Kyembogo, and in most cases yields are best under the shade; in Ankole the Banana shade has depressed the yield except on the row of Kents manured with ashes which may indicate that bananas compete for minerals and not moisture.

(b) *Coffee Shade Plot, Kyembogo Farm*.—All plots gave excellent yields. Banana shade and no shade gave the highest yields with *Ficus* third. *Antestia* gave little trouble this year.

West Nile—Shade Observation Plots at Payida and Warr, planted 1932.—Shade *Glyricidia* and *Leucaena*.

These were maintained, the results show that there is no difference between no shade or either shade but that coffee can be grown and be maintained in a reasonably healthy state for 14 years at least in the highlands of the West Nile.

(c) *Kents' Shade Treatment and Seed Supply Plot, Kyembogo Farm*.—The plot is two acres of Kents' Arabica for seed supply to the Western Province, and is shaded with the following trees: *Cordia Holstii*, *Acrocarphus fraxinifolius*, Yellow *Cassia*, *Ficus*, *Erythrina Abyssinica*, Banana and control no shade.

The top half of the plot is manured with one 4 gallon tin of kraal manure per tree twice a year. The bottom half of the plot has no manure.

The plot has given its second crop, which is a big one, and gave averages of 10 lbs. of cherry per tree.

On the two crops, *Erythrina* shade has given the biggest crop per tree, with no shade second and *Ficus* shade third.

Kyembogo soils are well supplied with plant nutrients and as expected, so far the effect of manure is not marked, only giving an average increase over the two years of 1.06 lbs. of cherry per tree over the non-manured section.

2. Robusta Coffee

(a) The demonstration plots of Nganda Coffee at Bulindi planted in 1941 have given the following total yields since 1943:—

YIELDS IN POUNDS CHERRY.

Banana Shade.		Ficus Shade.		No Shade.	
Mulched.	Unmulched.	Mulched.	Unmulched.	Mulched.	Unmulched.
135	114	877	739	1,069	863

The *Ficus* shade and the coffee trees under it have made excellent growth.

The Bananas are beginning to die out; the yields on the mulched sections this year gave lower yields than on the unmulched except in the Banana plot. In previous years yields from the mulched sections have been two and three times larger than on the unmulched. This is probably due to wetter weather.

(b) The observation plots at Ladonga and Nebbi in West Nile again gave no yield. No crop has been produced since 1941.

3. Tobacco

(a) *Fire-Cured Variety Trial—Bulindi Farm.*—This trial was continued but yields were not good, Mosaic and Curly Leaf doing much damage to all varieties. Frog Eye also heavily attacked Western (Nyasaland seed).

The results for the last four years in pounds per acre:—

Variety.	1942.	1943.	1944.	1945.	TOTALS.
Western (Bunyoro seed) ..	292	260	172	276	1,000
Western (Nyasaland seed) ..	390	364	360	156	1,270
Blue Pryor (Bunyoro seed) ..	394	356	200	128	1,078
Blue Pryor (Nyasaland seed) ..	272	240	204	200	916

(b) *High Nicotine Tobacco N. Rustica.*—Experiments with various varieties of *N. rustica* tobacco were conducted at Kachwekano. Very high yields were obtained, the best being:—

Brasilia ..	4,803 lbs. per acre with nicotine content 2.6% on dry matter.
Olson 68 ..	3,983 lbs. per acre with nicotine content 4.6% on dry matter.
Acholi ..	3,092 lbs. per acre with nicotine content 5.95% on dry matter.
Kigezi selected ..	2,615 lbs. per acre with nicotine content 5.90% on dry matter.

The nicotine content is low compared with the native grown crop which on market samples gave nicotine content of 8.0% to 9.42% on dry matter. On the other hand the yield of the native grown crop is much lower being about 600 lbs. per acre.

Olson 68, is probably the most promising variety but on trials so far conducted probably requires a spacing of 3 ft. by 3 ft. to give optimum yields.

These varieties and also spacing trials will be continued.

4. Cinchona

The 15.5 acres of *C. Josephianna* planted in 1943 at Kyembogo Farm were maintained. Growth has been excellent except at the 1 ft. by 1 ft. spacing the plants are overcrowded and tests on quinine content have shown the yield to be too low to warrant the cost of harvesting. This plot is now to be thinned out to a wider spacing and observations taken on the increase of quinine content.

At Kachwekano farm the *C. Officinalis* planted in August, 1942, has made good growth and is certainly better than this variety at Kyembogo. The *C. Josephianna* is however not growing so well as at Kyembogo.

5. Pasture Work, Ngetta

(a) *Grass Grazing Trial 1941.*—This experiment replicates a Serere-Ngetta trial comparing the effects upon subsequent crop yields of: (a) no grazing; (b) light grazing; (c) heavy grazing on: (1) *Cynodon*; and (2) *Chloris*

gayana. The first part of the Ngetta section of the trial was laid down in 1941 and ploughed up in 1944. To date crops of cotton and wimbi have been taken. Yields per acre have been as under in pounds per acre:—

Treatment.		1944.	1945.
		Cotton.	Wimbi (dry heads).
Heavy Grazing	..	409	2,582
Light Grazing	..	415	2,735
No Grazing	..	415	2,274
<i>Cynodon</i>	..	427	2,454
<i>C. gayana</i>	..	399	2,607

The results have not yet been analysed statistically but the indications are; (i) that grazing increases the yields of the subsequent crop; (ii) that the *Chloris gayana* may be superior to Natural Regeneration, i.e., *Cynodon*.

(b) *Grass Grazing Trial (1942)*.—This is a replication of the previous trial. It was planted a year later in Block VI and ploughed under in 1945. Yields in pounds of seed cotton per acre were as under:—

		<i>Cynodon</i> .	<i>C. gayana</i> .	TOTALS.
Heavy Grazing	..	695	789	1,484
Light Grazing	..	568	667	1,235
No Grazing	..	418	802	1,220
TOTALS	..	1,691	2,258	3,939

As with the grass grazing trial (1941) the tendency indicated by the results is that cotton gives higher yields after grazing. Likewise the seeded pasture gives a more rapid regeneration than the *Cynodon* (Natural Regeneration).

(c) *The Grass Grazing Trial 1944 and 1945*.—The trial which is run in conjunction with similar trials at Serere, compares the effect on soil fertility of: (a) "Grazing"; and (b) "No Grazing" on Natural regeneration with: (1) *Cynodon*; (2) *Chloris Gayana*; and (3) *Brachiaria decumbens*.

The first part of the trial was laid down in Block II in May, 1944, and the second part in Block III in May and June, 1945.

Grazing in Block II continued during the year according to plan.

In Block III the *Chloris gayana* was sown in October, 1944, under Sorghum when the latter received its final weeding. *Brachiaria decumbens* was planted in June, 1945. A good ground cover was formed in all plots and grazing was due to start in April, 1946.

(d) *Stock—Carrying Capacity of Ngetta*.—Grazing was again continued during the year at the rate of one beast per acre. The cattle were maintained in good condition.

6. Ngetta Soil Exhaustion Plot, 1928

This plot has been continuously cultivated since 1928. This year the yield of cotton was 286 lbs. of cotton per acre.

7. Beans and Peas

(a) *Abundance Runner No. 1298 and Canadian Wonder*.—Trials were carried out at Kyembogo and Kachwekano Farms and in Ankole. Yields for Abundance Runner were from 1,095 to 2,631 pounds per acre at Kyembogo. Canadian Wonder gave yields of 1,100 to 1,500 pounds per acre.

(b) *Broad Beans*.—At Kachwekano farm yields of 1,260 pounds to 1,584 pounds per acre were obtained.

(c) *Soya Beans*.—The following five varieties were grown at Bulindi farm, Kyembogo farm and in plots in West Nile and Mbarara.

The results in pounds per acre were:—

Variety.	Arua.	Bulindi.	Kyembogo.	Mbarara.	TOTALS.
No. 67	610	980	1,263	980	3,833
No. 184	1,034	936	1,154	1,285	4,409
No. 69	1,198	958	1,568	1,219	4,943
No. 68	1,187	958	1,416	1,219	4,780
No. 63	1,100	784	1,394	1,197	4,475

At Arua No. 67 was damaged by game and birds damaged No. 63 at Bulindi.

(d) The following variety trial of peas was again carried out at Kyembogo farm, and gave the usual good yields when planted in October.

Variety.	Yield per acre.
	lbs.
Harrison's Glory ..	1,098
Alderman	1,115
Dutch Marrow Fat ..	1,202

Plots were also planted in Ankole and at Kachwekano but the results are doubtful. At Kyembogo, plots planted in the spring rains did not give the usual yields and only averaged about 200 lbs. per acre. The plots were planted too early and suffered from excessive rains.

8. Groundnuts

The following variety trials were conducted at Bulindi farm, Ngetta Farm and centres in Lango and Acholi.

The results were in pounds per acre of unshelled nuts.

Centres.	B.239.	Atuboi.
Bulindi ..	2,087	1,985
Ngetta ..	2,862	2,413
Aduku ..	2,735	2,090
Alebtong ..	1,463	923
Koroto ..	1,986	1,934
Anyeke ..	1,742	1,279
Gulu ..	1,270	747
Kitgum ..	1,437	1,411
TOTAL ..	15,582	12,782
Average per acre all centres ..	1,948 lbs.	1,598 lbs.

The high yields of B.239 at all centres were again demonstrated. Atuboi is, however, more popular because of its ease of shelling, palatability and large and more attractive nut.

9. Grain Crops

(a) *Eleusine Trials*.—Trials were conducted at several centres in the Province, good yields were obtained up to 3,000 lbs. in the dry head. The results are varied and no conclusions are recorded.

(b) *Setaria Italica*.—Plots were grown at Gulu, Kitgum, Bulindi, Arua, Kyembogo and Nebbi. The yields were:—

			Lbs. per acre thrashed grain.
Gulu	..	..	654
Kitgum	..	..	686
Bulindi	..	..	1,284
Arua	..	..	684
Nebbi	..	..	328
Kyembogo	..	..	1,415
Matiri	..	..	1,524

Birds do much damage to this crop compared to *Eleusine*.

10. Cassava

Observation plots are being maintained in many centres to try out Mosaic resistant varieties.

11. Miscellaneous

(a) *Hedging Trials*.—At Kachwekano several species of plants have been planted in the past. The only ones that show any sign of being of practical use are—Sisal, *Aberia caffra* and *Crataegus crenulata*. Further trials are being laid down.

(b) *Sunflower*.—Plots were continued at Arua, Payida, Nebbi, Kyembogo and Kachwekano to test the possibilities of this crop at altitudes where other oil seed crops do not grow well. Yields varied from 1,000 lbs. per acre to 1,800 lbs. per acre.

One commercial firm has become interested in the possibilities of this crop.

A tall white seed variety is being grown which is badly damaged by wind and birds. A dwarf variety with a shorter growing period is required and which it is thought might prove more suitable.

(c) *Wheat*.—Observation plots on Ruwenzori of manured and unmanured plots planted in October, 1945 gave:—

		Lbs. per acre.
Manured	..	1,017
Unmanured	..	565

(d) *Sheep*.—The Kachwekano flock is still very disappointing. By bottle feeding the cross bred Merino lambs a larger number have been reared. The native ewes have not sufficient milk for these large cross bred lambs although it is thought that good supplementary feeding might assist the ewes to produce lambs more regularly and to be able to rear them.

REPORT ON KAWANDA EXPERIMENTAL STATION

Meteorological

	RAINFALL.				TEMPERATURES.			
	1945 Total	Average Total	No. of Days	Maximum	Mean Max.	Highest	Mean Min.	Lowest
1945—								
January	2.63	2.10	7	1.28	83.5	87.6	59.6	55.0
February	2.84	2.63	9	1.54	84.1	92.0	59.8	55.0
March	6.01	4.16	12	1.65	85.6	91.4	61.0	56.7
April	1.14	7.05	11	0.42	83.3	86.4	62.7	59.4
May	8.12	5.16	25	1.58	79.0	85.0	62.2	57.8
June	1.05	2.61	8	0.49	79.0	85.4	60.4	55.8
July	1.59	2.06	12	0.51	77.3	81.4	58.2	54.6
August	6.11	3.23	15	1.72	78.6	82.0	59.8	54.8
September	4.01	4.19	16	1.75	80.5	84.0	59.6	56.4
October	1.77	3.91	9	0.62	82.1	86.1	60.5	56.7
November	4.41	4.79	20	0.98	81.3	86.0	60.9	57.0
December	1.01	3.77	7	0.57	83.0	87.0	57.5	52.8
	40.69	45.66	..	..	..	..	..	..
1946—								
January	1.13	2.10	5	0.89	87.4	91.2	59.4	56.0
February	0.09	2.63	3	0.04	89.3	96.0	59.1	54.0
March	3.13	4.16	11	2.02	86.2	91.3	62.2	59.5

Rains during the early part of 1945 were erratic; April and June both showed the lowest totals recorded although March and May were well above average. Rain was well distributed from August to November, but dry weather set in in December and continued until March, 1946. This dry spell was much more severe than is usually experienced at Kawanda, and was accompanied by abnormally high temperatures.

Labour.

Labour difficulties encountered during the 1945 "troubles" were described in last year's annual report. Since then no disturbances have occurred and sufficient labour has been available.

Cotton, 1945-46

B.P. 52 was grown on the 20 acre increase.

YIELDS (LBS. SEED COTTON).

Block.	Area (Acres).	Sowing Date.	Yield.			Yield per acre.	
			Safi.	Fifi.	Total.	Safi.	Total.
X (1) ..	2.955	June 27th-28th ..	2,840	236	3,076	961	1,041
IX (1) ..	3.564	June 30th-July 2nd ..	3,416	202	3,618	958	1,015
X (4) ..	3.103	July 5th-6th ..	3,181	102	3,283	1025	1,058
IX (8) ..	3.220	July 16th-17th ..	2,508	79	2,587	779	803
IX (6) ..	4.446	July 18th-19th ..	3,871	75	3,946	871	888
VIII (6) ..	3.347	August 7th-8th ..	2,384	62	2,446	712.	731
TOTAL ..	20.635		18,200	756	18,956	881	91896

Cotton was planted later than has been the custom at Kawanda in the past in order that specialist officers might study disease factors in relation to Dr. Taylor's findings. Results will be discussed in detail in their reports.

Rainfall was rather low in June and July and germination of the earlier sowings was not good. Good rains were received in August and early September, but there was a dry spell from mid-September till the 21st October. Well distributed showers occurred from then until the end of November, after which dry weather set in and lasted until the end of February. Conditions for ripening and picking were ideal. Yields were the highest so far recorded on the 20 acre increase with the exception of the 1942-43 season. The crop was a healthy one, and the fifi percentage considerably lower than in any previous season.

Manilla Hemp

The plot has been maintained.

Sweet Potatoes

Block VIII strip four was planted on 23rd May, 1945. Some harvesting took place from September, 1945 to May, 1946, but the crop was a very poor one. Block IX strip four was planted at the same time. A fair crop was harvested during September and October, 1945.

The precise cause of poor yields on these plots is not known with certainty; it is probable that propagation of a poor variety was one cause. This year only cuttings of three of the best varieties are being used.

Ordinary Beans

Block X strip six (N. end) was sown on 26th October and harvested in January, 1946. Yields were:—

		Lbs. per acre.
Bukalasa	263	
Mutike No. 2	424	
Banja	466	
Tepary	597	

Sorghum

Block X strip six (S. end) was sown with L. 1, a white variety, in August. This was harvested in November and produced 1,294 lbs. (unthreshed heads) per acre. Bird damage was severe.

Cassava

Block *X* strip two was planted with six Mosaic resistant varieties Nos. 7, 8, 11, 13, 15 and 43, chosen by the Senior Botanist in April, 1946. No. 15 has subsequently been rejected. Most of this was cut in April and May, 1946, for distribution of planting material to various increase centres chosen by the Provincial Agricultural Officer, Kampala.

Sunflower

A one acre plot sown on Block *VII* strip one on 23rd October, 1945 was harvested in February, 1946 and produced 143 lbs. per acre.

Plantain Manurial Trial

This experiment was planted in August, 1942. There are nine rows each containing 31 stools. Three rows are manured with farmyard manure (about five tons per acre), three rows with rotten cotton seed (about 2½ tons per acre) and three rows unmanured. There are 31 varieties in each line, but comparisons between varieties have been invalidated by removal of suckers for planting in a Plantain Variety Trial which is being run by the Senior Botanist. Comparisons between manures are none too sound; the position on the plot might be expected to influence yield, but the figures given below suggest that manuring with farmyard manure has been beneficial.

GROSS YIELDS, 1943-45.

Average weight of bunch in lbs.			Treatment.	Yield (in the bunch).	Number of Bunches.
17.8	..	..	Farmyard Manure ..	5,296	297
16.3	..	..	Cotton Seed ..	3,927	241
17.8	..	..	No Manure ..	4,232	238

Elephant Grass Manurial Experiment

This experiment, which was started in 1943, was continued. A strip on Block *IV* is divided into 8 plots, half of which are manured annually with 10 tons per acre of farmyard manure and half not manured. Plots are cut at 4-monthly intervals. The summary of yields given below shows that responses to manure have been very big.

YIELDS (IN THOUSANDS OF POUNDS GREEN MATERIAL PER ACRE).

Block.	1943 1 cut.		1944 3 cuts.		1945 3 cuts.		TOTAL.	
	Manured	Not manured	Manured	Not manured	Manured	Not manured	Manured	Not manured
<i>I</i>	21	13	78	35	66	21	165	69
<i>II</i>	19	10	78	32	52	18	149	60
<i>III</i>	21	9	57	24	24	9	102	42
<i>IV</i>	12	8	29	17	17	8	58	33
	73	40	242	108	159	56	474	204

Though yields in 1945 were considerably less than in 1944 it is as yet too early to say whether this rate of cutting will eventually prove too heavy to maintain a fair elephant grass stand.

Farm Rotations

At the end of 1944 it was decided that the main farm at Kawanda should be altered so that evidence might be obtained as to the value of a number of different farming systems. It was decided that, though evidence from unreplicated trials must always be considered with some reserve, use of large plots on which normal farm operations can be carried out and reasonably accurate costs obtained was more likely to produce results than a series of small plot trials. The main factors included in the new layout, which was started in 1945, are:—

(a) CROPPING RATIO.

3:3 (*i.e.*, 3 years cropped and 3 years rest). Blocks *VII* and *VIII*.

4:2 Block *VI*.

4:3 Block *X*.

4:4 Block *IX*.

(b) MANAGEMENT DURING THE RESTING PERIOD.

(i) Elephant grass compared with short grass.

Elephant grass: Blocks *VI*, *VII*, *IX* and *X*.

Short grass: Block *VIII*.

(ii) Grazing compared with no grazing.

Elephant grass grazed (last year of rest only): Block *IX*.

Elephant grass not grazed: Blocks *VI*, *VII*, *X*.

Short grass grazed: Block *VIII*.

(iii) Trials with different species of short grass.

Block *II* (Botanist's area).

Block *VIII*.

The layout of these blocks of the main farm was altered during 1945 in conformity with these decisions, though the effect of previous cropping now has, and will continue to have for several years, a masking effect on results.

Short Grasses for Ley Grazing—Grazing Trials

(i) The following ten species were sown on Block *II*, strip nine in July. Notes on their establishment by March, 1946, are also given.

Species.	Condition on 12-3-46.
<i>Brachiaria decumbens</i> ..	Established well. Much lumbugu.
<i>Chloris gayana</i> ..	Established well. Some lumbugu patches.
<i>Cynodon</i> ..	Patches of <i>cynodon</i> , but much lumbugu.
Natural Regeneration ..	Much <i>Panicum</i> and lumbugu.
<i>Echinochloa pyramidalis</i> ..	Some <i>echinochloa</i> but much lumbugu.
<i>Eremochloa ophiuroides</i> ..	Little <i>eremochloa</i> . Nearly pure lumbugu.
<i>Setaria sphacelata</i> ..	Some clumps of <i>setaria</i> . Much bare land. Not much lumbugu.
<i>Paspalum notatum</i> ..	Some <i>paspalum</i> with much lumbugu and <i>Imperata</i> .
Elephant grass ..	Good stand. Little bottom cover but little lumbugu.
Kavirondo Sorghum ..	Good stand. Some lumbugu patches.

Grazing was started in April, 1946. The major objective of this trial is to see if any of these species will provide a reasonable amount of grazing, restore fertility and at the same time control lumbugu. This is asking a lot and it now appears unlikely that any of them will succeed, though *Brachiaria decumbens*, elephant grass, Kavirondo Sorghum and *Chloris gayana* are perhaps the best of a poor field. It should be borne in mind,

however, that this land contained much lumbugu (*Digataria scalarum*) when planting was carried out; had the land been cultivated for several years lumbugu would probably not have come in so rapidly.

(ii) On Block VIII, Strip two, the following four species were planted in May, 1946:—

Kavirondo Sorghum.

Cynodon.

Chloris gayana.

Brachiaria mutica.

Grazing was started in January, 1946. All species were grazed down very tight. It is of interest to note that the Kavirondo sorghum ratooned well after this grazing. All species are much mixed with other grasses, but *Cynodon* has shown the poorest establishment.

In this case the land is poor, rather stony soil and the plot does not contain much lumbugu.

Grazing of Elephant Grass

Block IX strip three had been planted with elephant grass in September, 1944. Owing to the change in the rotation it came into its last year of rest in 1945. Elephant grass was slashed in February and grazing carried out from February, 1945 to February, 1946. By this time the plot was one mass of lumbugu and opening up cost 124 man-days per acre. It should be clearly understood, however, that this high opening cost cannot be attributed to the grazing. I am informed that the plot was full of lumbugu before grazing was started and the elephant grass stand was poor.

Block IX, strip five was planted with elephant grass in May, 1944. This was slashed in February, 1946, and grazing started in that month. In this case the elephant grass stand was a good one. By June, 1946 there does not appear to have been much invasion by lumbugu, but opening costs in 1947 will in this case be of considerable interest.

Animal Husbandry

Cattle.—During the 12 months 9 heifers were purchased. There were 26 calves born, 17 bulls and 9 heifers, all sired by Lukwago except one by Thomas II, and one by an outside bull. One bull calf died from premature birth, and there was one abortion.

TABLE GIVING NUMBER OF CATTLE IN THE HERD FROM JUNE, 1943
TO JUNE, 1946.

	1943.	1944.	1945.	1946.
Bulls	1	1	1	2
Oxen	6	6	6	35
Cows	7	13	25	31
Heifers	9	15	11	22
Calves	6	21	34	30
	29	56	77	120

Trade Cattle.—The stall versus stall and grazing feeding trial was discontinued, but now that the weighbridge has arrived and been installed the experiment will be restarted. Weighing of calves and pigs will also be carried on in order to have a check on live weight gains. During the year under review 13 bullocks were transferred from Kampala Municipality to Kawanda. 19 fat bullocks were sold or slaughtered on the station. Two cows, Jameson and Ngobe, were also sold. The new cob kraal was finished in April and the cattle were moved in on the 28th, after division of the milking herd into two sections each respectively under the bulls Lukwago and Thomas II. On the 27th May, 17 bull calves were castrated, leaving three uncastrated. The general health of the cattle was good.

Pigs.—The large black herd was maintained. Two new pedigree gilts were purchased from the Elton Estates in Kenya, they arrived on December 26th. The herd now numbers one boar, four sows, seven gilts, and three young boars, a total of 15.

Boars.—Elton Victor 6th. Used throughout 1945.

Thorne's Utility. Legs broken in a fight with Elton Victor, and was slaughtered 4th August, 1945.

			No. of Litter.	Date of Birth.	No. born.	Total reared.	
						Gilts♀	Boars♂
Elton Glory	}	..	3rd	24- 5-45	♀5+3♂	4	2
		..	4th	11-12-45	2+5	Nil	1
		..	5th	8- 6-46	2+8	1	1
Elton Majestic	}	..	3rd	24- 5-45	6+8	Nil	Nil
		..	4th	18-11-45	3+4	3	2
		..	5th	14- 5-46	4+3	1	Nil
Kawanda 3rd	..	..	1st	11- 6-45	3+1	1	1
Kawanda 4th	..	..	1st	3- 7-45	2+1	Nil	1
Kawanda 5th	..	..	1st	30- 1-46	1+4	1	4
Kawanda 6th	..	..	1st	2- 2-46	3+3	3	3

Both Elton Majestic and Elton Glory had no milk after farrowing, this may have been due to feeding raw cassava, but the former has a poor record and will be slaughtered. Kawanda 3rd and 4th, daughters of Elton Majestic were poor types and both were sold. All progeny reared, apart from one boar of Kawanda 5th and 1 boar and 3 gilts of Kawanda 6th retained for departmental use were sold to Africans. The demand continues far to exceed the supply.

Poultry.—Two breeds, Rhode Island Red and Australorp were kept, but the latter are neither so popular nor such good layers, so that no further breeding is being carried on. The birds are kept on free range and although generally healthy a number were lost from attacks by wild cats, dogs, and theft. Twenty-four pullets and two cockerels were bought from Kenya to bring in new blood; these birds arrived in December.

Egg Laying Records.

	Rhode Island Red.	Austrolorp.	Totals.
Total Eggs laid during year	3,778	990	4,768
Sitting Eggs sold to Europeans	468	3	471
Sitting Eggs sold to Asians	41	..	41
Sitting Eggs sold to Africans	303	5	308
Sitting Eggs kept on the station	164	6	167
Eggs sold for eating	..	..	3,712
Average number of laying hens	38	12	..
Eggs per hen per year	99	82.5	..
Highest laying record Rhode Island Red	12.2	eggs per bird July, 1945.	
Lowest laying record Rhode Island Red	4.6	eggs per bird May, 1946.	
Highest laying record Austrolorp	9.1	eggs per bird November, 1945.	
Lowest laying record Austrolorp	2.75	eggs per bird June, 1946.	

Losses.—Thirty Rhode Island Red hens, two cocks and four Austrolorp hens were lost during the year making a total of 36. One from inflammation of the intestines, three from peritonitis, one from an impacted crop, one from haemorrhage, two killed by dogs, fourteen killed by wild animals, probably serval cats, one by an eagle, two stolen, nine from unknown causes, one cock died from paralysis, and one was stolen, two chicks died from gapes. At the end of June there were eight Muscovy ducks, one drake, and three young ducklings.

Milk.—The average production per cow per day was 2.2 pints only.

The records indicate that a very considerable amount of culling is required, but one or two cows are sufficiently promising to suggest that they will form the nucleus of a reasonable herd when the effect of using bulls of known high milking strains has had time to show up.

A few cows have had extremely long lactations, over 400 days in two cases; this is almost certainly undesirable and all cows will be dried off at a maximum of 300 days in the future.

R. K. KERKHAM,
Agricultural Officer i/c, Kawanda.

REPORT ON SERERE EXPERIMENT STATION

Meteorology

RAINFALL SUMMARY.

Month.	1945.	Average 1921-45.	1946.
January ..	0.85	0.83	Nil
February ..	2.23	2.45	Nil
March	1.19	3.53	4.06
April	1.43	7.83	..
May	12.98	7.31	..
June	1.90	4.30	..
July	5.17	4.57	..
August ..	10.19	6.47	..
September ..	9.94	6.03	..
October ..	4.05	4.34	..
November ..	6.51	4.00	..
December ..	0.35	2.03	..
TOTALS ..	56.79	53.69	..

1945.—The failure of the spring rains to break until May meant that not only were the food crops planted two months later than usual but also that the bulk of the cotton crop which is not planted until the food crops have been harvested was also correspondingly late planted. The short dry season in June was also much drier than usual and this fact coupled with late planting was largely responsible for the poor yields of most crops.

The rainfall in August and September was well above average and although favourable for the root crops made the harvesting of the groundnut crop extremely difficult and was no doubt largely responsible for the heavy incidence of Blackarm disease on the cotton. Rainfall in October was average and well distributed, but the 6.51 inches recorded in November gives an extremely false picture in that three-quarters of this amount fell during the last two days of the month and did more harm than good.

1946.—For the first time on record no rain fell during the first two months of 1946. On two previous occasions, 1924 and 1935, has no rain fallen in January, but some rain has always been recorded in February. The grass rains which are usually received towards the end of February failed this year but the rainfall in March was on the whole good in that the first rains were unusually gentle, the 4.06 inches received being evenly distributed over 14 days.

Main Farm

Cropping was continued according to programme; for details *see* crop sections.

Crops 2nd Rains 1945

COTTON.

Variety S.P. 84 (Toroma) was grown on the main farm. As a check on *Lygus* damage no cotton was planted before 26th June. The incidence of Blackarm was heavier than usual and this fact coupled with the late planting was largely responsible for the low yields which averaged 437 lbs. per acre.

The following table shows the average yields for each planting month:—

Month of planting.	Average yield Acre in lbs.	Safi per acre in lbs.	Fifi per acre in lbs.	Fifi %
June	552	486	66	12.0
July	402	354	48	12.0
August	336	278	58	17.4

It was not a severe *Lygus* year, and it is not possible to say whether the late planting had any appreciable effect in reducing the amount of *Lygus* damage. The yield figures mean very little in this connection as the incidence of Blackarm was heavy. It is interesting to note that contrary to expectation the percentage of fifi was highest in the August planted cotton.

BP 50. B.A.R. was grown on the three acre increase and produced 397 lbs. per acre, but the fifi percentage was only 8.4.

Eleusine (Finger Millet)

Owing to the delay in the rains, the *Eleusine* crop was generally poor throughout the farm. A total of 32 acres was grown and gave a mean yield of 1,325 lbs. per acre. On B4E six varieties were planted in pure stands with the following results:—

Variety.	Yield per acre (dry heads).
Engenyi	2,564
Elkwakoit	986
Emiroit	796
Odyero	189
Enyomu	440
Emoru	424

The outstanding superiority of *Engenyi* under the prevailing conditions of late rains is very significant.

The most expensive item in the cost of growing *Eleusine* is the relatively high cost of weeding. In order to investigate this problem a trial was arranged to compare the labour requirements for row planted *Eleusine* as against that sown broadcast. The results were as follows:—

Treatment.	Labour in Man Days.	Yield in lbs. per acre (Dried Heads).
Rows	16	1,512
Broadcast	15	2,094

One explanation of the low yield with row planting is that the thinning was done too late. The experiment is being repeated in 1946.

Sorghum 1945

As with *Eleusine* yields were low. On A4C the variety T15 was grown intermixed with "Nsinsze" a yellow type of maize, and produced a crop of 1,138 lbs. per acre of unthreshed heads. Unfortunately most of the maize which survived was stolen. Sorghum for silage, variety T7, was grown on C2E, C2C, C2E, D2W and D1E, a total of 14 acres, but was insufficient

to fill the silo pit and *Panicum maximum* had to be cut to make up the deficiency. This year, 1946, 15 acres planted in early March and harvested at the end of May and early June gave a big crop which was sufficient to fill both silo pits. The value of this sorghum silage cannot be over-estimated as it provides useful supplementary stockfeed during the dry weather when grass is scarce, and enables the milk yields to be maintained.

Groundnuts

The variety B239 was grown and yields generally were poor. 2.63 acres on B2C gave a mean yield of 854 lbs. per acre (unshelled), and five acres grown on Paddocks 1-5 gave an average yield 1,278 lbs. per acre (unshelled). Owing to the heavy rains received in August harvesting of this variety B239 was exceptionally difficult and the labour had to work in double shifts. The lack of drying space added to the difficulties, and some germination took place owing to the large amount of earth adhering to the nuts.

On A4E groundnuts interplanted in cassava gave a yield of only approximately 60 lbs. per acre.

1946.—A total of 13 acres is being grown on the Main Farm. Germination was satisfactory and crop prospects are good. Three varieties are being grown, B239, *Atuboi*, and B227. The latter is a nut similar to B239 but much easier to harvest as it comes away more easily from the stem, and is easier to clean.

Sesame

Although always a disappointing crop at Serere yields in 1945 were worse than usual. Approximately three acres on A2C yielded at only 136 lbs. per acre for the Kamod type and 101 lbs. for the Kumam. The Buganda method of drying the crop by stacking was tried but there was more loss from shedding as compared with the Teso method of fastening the sheaves to large drying racks.

Approximately two acres of the Kumam and Kamod types are again being grown this year on D4W but the stand is only fair.

Maize

Njoro white, local yellow and American yellow were grown in the Plant Introduction area for seed supplies. Yields were satisfactory

Soya Beans

Yields were all low and may be summarised as follows:—

Variety.	Sowing Date.	Harvesting Date.	Yield per acre in lbs.
S42	2-5-45	9-8-45	154
Venezuelan	2-5-45	9-8-45	140
R184	2-5-45	31-7-45	284
Dixie	2-5-45	31-7-45	233
Black Soya	2-5-45	31-7-45	175

Under Serere conditions a yield of 400 lbs. per acre would be considered good.

Peas and Beans

Various types of peas and beans were planted to maintain seed stocks for distribution.

All the yields were poor compared with 1944 when, *e.g.*, the Mauritius type of Field Pea yielded at the rate of 880 lbs. per acre and the lowest was Alderman with 530 lbs. The reasons for the low yields in 1945 are not clear but were undoubtedly associated with a rainfall heavier than usual in July and August. Of the beans, Canadian Wonder has proved a useful yielder in the past (up to 330 lbs.) and its low yield this year is all the more disappointing. The recently introduced Abundance promises well.

Small plots of all the above varieties were tried in the second rains of 1945 but all yields were disappointing; Victory at 198 lbs. per acre being the best of the beans, with Harrison's Glory at 165 lbs. per acre the best of the peas.

Cowpeas.—Yields in the second rains were as follows:—

Field.	Previous Crop.	Planted.	Harvested.	Yield per acre in lbs.
D2E ..	Eleusine	8-9-45	28-11-45	438
B4E ..	Eleusine	15-9-45	14-12-45	119

Tepary Beans.—All available ground was planted with this useful catch crop which is proving very popular. Yields were as follows:—

Field.	Previous Crop.	Planted.	Harvested.	Yield per acre in lbs.
D1E ..	Sorghum Silage	2-8-45	17-10-45	401
D2E ..	Eleusine	8-9-45	14-11-45	426
A6E ..	Interplanted in cotton ..	14-9-45	26-11-45	56
A4C ..	Maize and Sorghum ..	14-9-45	29-11-45	258
D2W ..	Bulrush Millet and Setaria	14-9-45	29-11-45	273
C2E ..	Cassava	25-9-45	9-12-45	172
C4E ..	Eleusine	22-9-45	8-12-45	192

The comparatively heavy yields of the earlier plantings were due to very favourable rains in the early stages which resulted in an excellent cover and suppression of weeds. As regards the interplanting of cotton with tepary beans, the above result means very little because in a controlled experiment carried out by the Botanist on the Experimental Farm it was found that the interplanting of cotton planted in June and July with either tepary beans or Canadian Wonder beans did not depress the yield of cotton as compared with cotton planted alone. Similarly there was no significant difference in yield with either type of bean when interplanted in cotton as against when the beans were grown in pure stand. Previous results at Serere had shown that interplanting of cotton with tepary beans did depress slightly the yield of cotton but only to a minor extent.

Cassava.—Bulk increase plots of Numbers 8, 11, 14 and 15, all mosaic resistant, were grown on the main farm and cuttings were distributed to Mbale, Busoga and Teso Districts.

Sweet Potatoes.—A total of 17 acres was grown on the Main Farm and gave a mean yield of 2,780 lbs. per acre which is low for Serere. The highest yield was 4,041 lbs. per acre and the lowest 740 lbs. The latter crop being very late planted was much damaged by weevils. As in the case of all root crops grown on the Main Farm where it is almost impossible to guard the crops, some thieving took place. Most of the crop was dried down into "Kasode" and fed as rations to porters.

Setaria Italica.—One acre of Variety S5 grown on the Main Farm yielded only 739 lbs. per acre. Although this recent introduction has not been taken up by the growers in this Province it does serve as a useful foodstuff for pigs and poultry. It is never likely to compete with *Eleusine* in a normal year, but will produce a crop in the second rains which *Eleusine* will not do.

Bulrush Millet (*Pennisetum*).—On the Main Farm half-an-acre of the local awned type and half-an-acre of the Acholi type were grown on D4W but yields amounted to only 120 lbs. and 110 lbs. respectively. The depredations of birds were severe in both cases. The later plantings made during the third week of September did better and yielded 305 lbs. and 605 lbs. per acre respectively.

Rice.—Three acres were again grown below the atapar (impounded spring). Owing to the shortness of the spring rains very little irrigation was possible and all yields were disappointingly low. Two Nyasaland varieties, "Likoti" and "Bungara", were given a trial and yielded 702 lbs. and 320 lbs. per acre respectively as compared with local Afaa at 902 lbs.

Approximately four acres of Afaa were planted in March, 1946, and crop prospects are good, as it was possible to irrigate. Large numbers of mosquito larvae (*Anopheles gambiae*) were found breeding in these rice plots and the plots were dusted with Paris Green at the rate of 1 lb. per acre, but as this proved ineffective it was necessary to oil a small area and although some damage was done to the plants the amount of damage was nowhere serious.

Miscellaneous Vegetables and New Introductions.—Various introductions were tried during the latter part of 1945, including:—

Upright Cowpeas, from Potchefstroom—strains 34, C361, 37 and C6.

These all failed to set seed.

Caesium Wheat (Russian) from Potchefstroom. A complete failure.

Dolichos lablab (Fiwi) from Mpwapwa; to be given a further trial.

Sahara Yellow Maize from Potchefstroom; to be tried in Karamoja.

Short Term Dwarf Sorghums from Ukiriguru, Tanganyika; to be tried in Karamoja.

Panicum Millet from Ukiriguru; further trial in Karamoja.

Sunflower from Ukiriguru; to be increased in 1946 and tried as chicken feed.

Voandzeia subterranea—8 types were tried and although yields were disappointing they will be tried again in 1946.

NURSERY BEDS.

Desmanthus virgatus.—Used as a forage plant in Hawaii. Seed collected and sown in intermediate grass plots.

Stylosanthes guianensis.—A spreading legume from Queensland. Seed sown in intermediate grass plots.

INTERMEDIATE GRASS PLOTS.

Glycine Javonica from Mpwapwa.—Most died out in dry season and the remainder has made little growth.

The following grasses were tried:—

Digitaria sp. from Karamoja (Kawanda collection No. 25)—died out.

Echinochloa sp. from Lango (Kawanda collection No. 30)—a few clumps remain.

Chrysopogon aucheri from Karamoja (Kawanda collection No. 18)—died out.

Brachiaria mutica from Lango (swamps) (Kawanda collection No. 8)—a few clumps have been established.

Panicum infestum from Mulondo—still being grown in the nursery beds.

Nurseries.—The policy of transferring citrus fruits from nurseries to nursery rows at 4 ft. by 1 ft. spacing was continued with the result that it was possible to distribute larger trees which are believed to have a higher survival rate, although no reports have been received here. The following is a summary of the seedlings issued in 1946:—

Sweet oranges ..	679	Grape fruit ..	239	Tangerines ..	248
Lemon ..	179	Lime ..	117	Marmalade Orange	156
Avocado Pear ..	14	Guava ..	37		
Cashew Nuts ..	28	Mulberry ..	39		

Soil Conservation and Agronomy

General.—In 1945 the break of the rains was such as to cause the maximum amount of erosion. The break of the rains in 1946 however was extremely gentle, in fact, a feature of the spring rains has been the absence of heavy precipitations and even distribution. The only serious erosion to be seen was on the farm roads which in spite of heavy lorry traffic by the Public Works Department have stood up well, although constant attention to the many bunds was required.

Some sheet erosion again took place on the bottom two strips of the Training Farm but although there was some movement of water through the grass strips most of the soil was held back. On the alternate strip system adopted on most of the Main Farm no appreciable sheet erosion took place this year, and there was no sign of water movement through the grass plots.

To summarise, under the present system of grass stripping and in the absence of any really heavy precipitation no appreciable erosion took place except on the farm roads.

Thorn Scrub Eradication

Mulondo.—Much of the area reserved for late burning has now been opened and is under cotton. There is little doubt but that a fierce burn, only to be obtained by late burning, is the only effective method of thorn eradication open to the peasant farmer.

Serere.—Some preliminary trials with diesel oil were carried out on *Acacia campalycantha*. The oil was applied about a foot above ground level and very soon afterwards the trees began to die. Further trials will be carried out when the labour position permits.

Manurial Experiment. Block 4. Old Farm

This experiment was on the 1st year of the 5th cropping cycle and was under cotton. There was a strong linear response to farmyard manure. 30 tons per acre gave 3 times as much seed-cotton as unmanured.

	Cotton Yields.			Significance.	
	Total Seed Cotton per acre.				
Control	..	..	..	162	..
Lime	..	..	..	170	..
FYM 10 tons per acre	..	..	..	404	Linear for manure 1000 : 1
20 tons per acre	..	..	..	455	
30 tons per acre	..	..	..	550	

Time of Opening-up of Land Experiment P.7

This experiment was designed to compare the effects of opening up land in (1) August, (2) October, (3) February, and (4) April, combined with two after cultivation treatments:—

1. No further digging until April.
2. Dug over bi-monthly.

Cotton was planted six weeks after the last April cultivation.

YIELDS OF COTTON IN LBS. PER ACRE.

Opened up in.			No Further Digging until April.	Dug over bi-monthly.	Means.	L.S.D. P = .05
August	..	..	430	583	507	..
October	..	..	430	546	488	68
February	..	..	431	409	420	..
April	..	..	379	385	382	..
L.S.D.	..	..	98	98	..	..
Means	..	..	418	481	449	48

Discussion.—Although it would be unwise to draw any conclusion from the first year of the experiment there are strong indications that bi-monthly cultivations increased the yield of cotton in the case of the earlier opening-up (August and October) but had no effect on the later opening-up (February). In other words land opened up in the previous Autumn responds to after cultivations at bi-monthly periods prior to planting, whereas in the case of land opened up in the spring there is no such response. In the case of the land opened up in April there was no time for after cultivations and the two treatments are therefore the same.

A second crop of *Eleusine* was taken in the Spring rains of 1946 to test out the residual effect but results are not yet available.

Fertility Experiment—for Yields see Appendix I.

SUMMARY OF 1945 RESULTS.

(a) In the case of May-sown cotton on land in the first year of the second circuit (Cycle V) yields were generally average and as usual there was no response to farmyard manure.

(b) Cotton following *Eleusine* in the second year of the second circuit (Cycle IV) gave a marked linear response to comparatively small doses of farmyard manure.

(c) *Eleusine* again gave very clear cut increases in yield with increased resting period (or decreased time of cropping) Cycle IV.

(d) Cotton following *Eleusine* showed no response to increasing resting period.

(e) Groundnuts following cotton in the third year of the second circuit (Cycle III) showed a linear response to manure applied the previous year.

(f) Cotton in the fourth year of the second cycle responded to manure applied two years before.

(g) Sweet potatoes following groundnuts in the third year of the second circuit (Cycle III) also showed a strong linear response to manure applied the previous year.

(h) Responses to different cover crops during the resting period prior to cropping were again insignificant.

Regeneration Experiment, Block 5. Old Farm

This experiment has been resting under the following regenerative treatments since 1940:—

(a) *Cynodon* planted.

(b) *Pennisetum polystachyum**

*Rhynchelytrum repens**

*Chloris gayana**

(c) Planted elephant grass.

(d) Pigeon Pea.

(e) Sorghum followed by natural regeneration.

(f) Cassava (long term).

All plots were ploughed, in August, 1944, and in 1945, plots were then split up into two, one half being sown with mixture of *Eleusine* and Sorghum followed by Cow peas, and the other half was sown to cotton. There were no significant differences between treatments, and the experiment is now terminated.

Cotton Seed and Meal Experiment

This experiment has now been concluded and is fully reported on from its inception in the Senior Chemist's report. The cotton seed and ash experiment is resting until 1947.

Prior Treatment of Cropped Land

The experiment was designed to investigate the effect of various cultural treatments on the following cotton crop. These treatments included ploughing in August for a mucuna crop, a practice which had been standard at Serere for many years. The results from cotton (1944/45) fully demonstrated that this treatment is in no way superior to normal native practice and the

*Sown in Sorghum as nurse crop.

practice of opening to a mucuna crop has now been abandoned. To complete the experiment a crop of *Eleusine* was taken to test out the residual effects of the various treatments but treatment differences were not significant.

Grazing and Grass Testing

Farmyard Manure versus Dropped Trial.—The trial continued in two sections to test out the effects of the treatments on the subsequent crops.

During the period under report:—

(a) P.1–5 were in the second year of cropping and the following crops were taken: (1) groundnuts, (2) tepary beans, (3) sorghum.

(b) P.11–15 were in the second year of rest having been cropped from 1941–43.

Treatments are:—(1 acre paddocks).

A. P.1 and P.12. Grass cut for bedding on P.12 for two beasts which are kept in a kraal and the manure applied to P.1. Grass for food cut on a separate pasture.

B. P.2 and P.14. Grass cut for bedding on P.14 for two beasts which are kept in a kraal at night only. Manure applied to P.2. Cattle graze during the day on a separate pasture.

C. P.3 and P.13. One beast grazed day and night on P.13 (on P.3 during the previous 3 years).

D. P.4 and P.15. Two beasts graze on P.15 during the night. Graze on separate pasture during the day (on P.4 during the previous 3 years).

E. P.5 and P.11. Two beasts graze on P.11 during the day. Graze on separate pasture during the night (on P.5 during the previous 3 years).

In treatments A and B grass is used for production of manure. On treatments C, D. and E it is used for grazing in the field.

(a) P.1–5 CROP YIELDS.

These one acre plots were split into two halves and were cropped as follows:—

1944 half under cotton, half under *Eleusine* followed by cowpeas.

1945 all under groundnuts followed by tepary beans and sorghum.

Plot.	Treat- ment.	Cotton 1944/45.	Eleusine 1944.	Cowpeas 1944.	G.nuts 1945.	Tepary Beans 1945.	Sorg- hum 1945.	1946.
P. 1 ..	A ..	521	1,929	328	1,498	275	2,770	All under sweet pota- toes planted in June.
P. 2 ..	B ..	484	1,441	361	1,445	239	2,022	
P. 3 ..	C ..	429	1,156	396	1,534	244	1,989	
P. 4 ..	D ..	453	1,555	366	1,087	247	2,044	
P. 5 ..	E ..	390	1,261	414	827	202	1,557	

Cotton yields in lbs. seed cotton per acre.

Eleusine yields in lbs. dried heads per acre.

Cowpeas yields in lbs. grain per acre.

Groundnuts yields in lbs. unshelled nuts per acre.

Tepary beans yields in lbs. grain per acre.

Sorghum yields in lbs. dried heads per acre.

In 1943/44 season cattle were removed in February.

1944/45 season cattle were not put in until June.

1945/46 season cattle were put in April, 1945 and there was sufficient grass on P.12-15 but those on P.11 had to be taken out on the 11th January, 1946, and were not put back until March. All cattle were given 2 lbs. of cotton seed per day during the dry season.

(b) P.11-15. Cattle Liveweight Gains compared with P.1-5.

YEAR=APRIL TO MARCH.

Treatment.	Plot.	Bullock.	1941-42.	1942-43.	1943-44.	Plot.	1944-45.	1945-46.
A	P. 1 ..	(i) .. (ii) .. Total ..	WEIGHBRIDGE NOT IN USE	116 94 — 210	—12 100 — 88	P. 12 ..	—9 —28 — —37	168 112 — 280
B	P. 2 ..	(i) .. (ii) .. Total ..		94 93 — 187	153 154 — 307	P. 14 ..	137 123 — 260	145 207 — 352
C	P. 3 ..	(i) ..		177	108	P. 13 ..	76	161
D	P. 4 ..	(i) .. (ii) .. Total ..		195 169 — 364	123 113 — 236	P. 15 ..	142 149 — 291	186 169 — 355
E	P. 5 ..	(i) .. (ii) .. Total ..		142 141 — 283	92 64 — 156	P. 11 ..	122 167 — 289	203 117 — 320

Discussion.—At this stage it is impossible to analyse the results statistically, but in general the results confirm last year's experience, and may be summarised as follows:—

(i) The cattle that were kept in the kraal all the time with an average gain of 140 lbs. during the year did not do quite as well as those allowed to graze. However the difference was not so marked as in the previous year.

(ii) There is again no consistent difference between cattle kept outside day and night and those sleeping in a kraal at night and grazing outside during the day.

(iii) The paddock with one beast grazing day and night was much more closely cropped than the other paddocks, and the indications are that one animal per acre is slightly on the heavy side under the conditions of the experiment.

(iv) The results again confirm that two beasts during the day only is a much heavier grazing rate than two beasts grazing day and night, *i.e.*, the value of the manure dropped at night more than compensates for the grass eaten.

(v) Treatment A (manure made in the kraal) has given the highest yields in the case of four out of the six crops taken. Even so, it is unlikely that the increase in yields would compensate for the extra cost of applying the manure, and in the light of present knowledge the policy of advising the peasant farmer to graze his cattle on the resting land as against kraaling them should be continued.

(vi) In the four years 1942-1946 treatment D (unlimited grazing, except at night) has consistently given the highest liveweight gains.

Rotational Grazing Trial. C.6 (E) Main Farm

The plots are approximately $1\frac{1}{2}$ acres in size, and were grazed by two bullocks each during the 3-year period prior to cropping with cotton in 1945.

TREATMENTS:—

P.42. Grazed by tethered cattle in the day only, starting in the first year of rest.

P.43. Continuous grazing started in the first year.

P.44. No grazing.

P.45. Rotational grazing 30-day cycle with two sections. Grazing started in the first year.

P.46. Continuous grazing—started in the second year of rest.

P.47. Rotational grazing with a 60-day cycle with two sections, started in the first year.

CATTLE LIVEWEIGHT GAINS (LBS.) AND YIELD OF COTTON IN LBS. PER ACRE.

Plot No.	Bullock.	1942/43 July-Dec.	1943/44 April-Nov.	1944/45 June-Feb.	1945/46 Cotton.
P. 42	(i)	GRAZED, NOT WEIGHED	71	122	..
	(ii)		92	72	..
	Total ..		163	194	758
P. 43	(i)		69	161	..
	(ii)		64	190	..
	Total ..		133	351	694
P. 44			..	..	567
P. 45	(i)		102	117	..
	(ii)		157	154	..
	Total ..		259	271	631
P. 46	(i)		141	102	..
	(ii)		189	99	..
	Total ..		330	201	490
P. 47	(i)		—31	66	..
	(ii)		95	116	489
	Total ..		64	182	..

It would be dangerous to draw any conclusions at this stage as a statistical analysis is not yet possible. The indications are that in the case of liveweight gains, continuous grazing started in the second year of rest was better than that started in the first year. Rotational grazing with a 30-day cycle was much superior to rotational grazing with a 60-day cycle.

As far as crop yields are concerned grazing by tethered cattle, continuous grazing started in the first year and rotational grazing with a 30-day cycle were all superior to no grazing which in turn was better than continuous grazing started in the second year and rotational grazing with a 60-day cycle. These results were complicated by a marked fertility trend; but in no case was the cotton yield on grazed lower than on ungrazed; in most cases it was higher. Further results will follow in succeeding years.

Deferred Grazing.—Block 8. This block is still being grazed.

P.54–56. These three five-acre paddocks continue to be grazed on a deferred system, P.54 being closed during the present rains. An average of twenty young heifers were maintained but liveweight gains have been disappointing and some supplementary feeding was necessary.

No—Light—Heavy grazing Trial B6E, C1C, C1E, C3E.

The position is as follows:—

P.16–21. Laid down in 1940 1st cropped in 1945 with cotton.

P.36–41. Laid down in 1941 1st cropped in 1946 with cotton.

P.48–53. Laid down in 1942 1st cropped in 1946 with cotton.

P.57–62. Laid down in 1943 grazing continued. Will be opened to cotton in 1947.

P.16–21. Yields of cotton 1945/46 season were as follows:—

Plot No.	Area.	Treatment.	Safi per acre.	Fifi per acre.	Total seed cotton per acre.	Fifi %	Remarks.
	<i>Acres.</i>		<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>		
P. 16 ..	0.5	No Grazing ..	332	52	384	13.5	Fertility Gradient ↓ Ironstone.
P. 17 ..	0.5	Heavy Grazing ..	472	64	536	11.9	
P. 18 ..	0.5	Light Grazing ..	458	62	520	11.9	
P. 19 ..	0.5	Light Grazing ..	444	62	506	12.3	
P. 20 ..	0.5	Heavy Grazing ..	384	84	468	17.9	
P. 21 ..	0.5	No Grazing ..	356	66	426	15.5	
Means ..	..	..	408	65	473	13.7	

Light grazing=1 beast per acre.

Heavy grazing=2 beasts per acre.

		Average Yield per acre.	Fifi.
		<i>Lbs.</i>	%
No Grazing ..	..	405	14.5
Heavy Grazing ..	..	502	14.9
Light Grazing ..	..	513	12.1

Discussion.—Statistical analysis of the results will not be possible until the experiment has completed its first circuit, but the results confirm the results of other experiments in that grazing certainly does not decrease the yield of cotton and the indications are that careful grazing will increase yields.

Quarter-Acre Grass Plots

Grazing records and plot notes for the year 1945, and a summary of previous results are given in the Tables in Appendix II.

After each seeding each plot was weeded once, but not more than once, *i.e.*, if a species cannot stand up to competition from self-sown grasses it will die out. It should again be noted that in many cases the grazing records refer to the grazing value of natural regeneration rather than to the species sown.

Results to date may be summarised by stating that we have yet to find a grass or grass mixture which is superior to natural regeneration which at Serere means *Cynodon plectostachyum* on good land with some *Panicum maximum* in the first year followed by *Imperata*, *Sporobolus* and lesser amounts of *Hyparrhenia* and *Setaria* in subsequent years. *Cynodon* is a good grazing grass (P.112) and although this grass is difficult to eradicate when opened to cropping it is not an insuperable difficulty provided the land is well grazed down prior to opening up. *Chloris gayana* is promising but it is clear that what is required is a mixture of grasses, which are not only palatable to stock but which will persist throughout the resting period. Two other grasses which merit further examination are *Cenchrus ciliaris* of which several strains are being tried, and *Paspalum dilatatum*, *Leucaena glauca* gives valuable grazing in the dry season but even so it tends to become too "woody" as cattle will not eat it when more succulent grazing is available during the rains.

Grass Museum.—This was maintained. The only new introductions were from Lubaga in Tanganyika, *viz.*:—

Cenchrus ciliaris. Ref. No. 4/2. Flattish habit.

Cenchrus ciliaris. Ref. No. 4/6. Upright, fairly vigorous.

Cenchrus ciliaris. Ref. No. 5/2A/1. Flat vigorous.

Cenchrus ciliaris. Ref. No. 5/4/1. Tall, very vigorous.

Cenchrus ciliaris. Ref. No. 5/20/2. "Blue" foliage.

Chloris gayana. Ref. No. 5/5/3. Possibly an unusually vigorous Rhodes.

Hedging Trials

The following have proved successful under local conditions:—(1) Mauritius thorn *Caesalpinia sepiaria*. (2) *Aberia gardneri*. (3) *Carisosa edulis*. (4) *Acacia senegal*. (5) *Cassia siamea*. (6) *Ficus sp.* Of these Mauritius thorn is easily the best being easy to grow from seed and is reasonably stock proof although it does tend to die back from the bottom upwards unless pruned and weeded. *Aberia gardneri* and *Acacia senegal* are also cattle proof, but as all take from 3-4 years to form a compact hedge they are unlikely to prove useful for the enclosure of temporary leys. Even Mauritius thorn has to be repeatedly reinforced with a barbed wire fence and with the present high prices ruling for livestock and livestock products it is considered that fencing with live posts and barbed wire is now well within the means of the progressive stockowner, and is to be recommended rather than any hedging plant so far tried.

Cuttings of *Commiphora Berryi* were received from the Imperial Sugar Station, Coimbatore, but although they arrived in excellent condition and were planted out in the rains, all were attacked by white ants and died.

Livestock

Bulls.—The two stock bulls—Katerega (L.6) and Oula (L.71) continued to run with their respective herds and have done all that was expected of them. The size of the milking herd now justifies a third bull and it is hoped to purchase one of good milking strain from Ngetta.

Four young bulls were sold to Busoga Native Administration and there is a keen demand for any bulls of serviceable age. Six will be available for sale in 1946 of which one has been promised to the Veterinary Department.

Cows and Heifers.—There were 78 cows and heifers in the herd on the 1st January, 1946, and 16 heifers were brought in from the calf herd making 94 in all. Of these 9 were culled and slaughtered on account of poor milk yield, one suffered a broken leg and had to be destroyed, one was killed by a hyena and one by a leopard, leaving a balance of 82 as at the end of the year. It is proposed to increase the dairy herd up to 100 cows.

In order to increase milk production considerable time was spent in training heifers to let down their milk without a calf at foot, and although first results were disappointing there are now 5 heifers being milked without their calves all of which are promising milkers. Furthermore some animals which failed with their first calf have been successful with their second. Yields of well over a gallon a day have been recorded but the lactations are not yet complete.

Working Herd.—At the end of 1945 the working herd consisted of 128 animals of which all but 19 had been trained for work. We are now in a position to cull poor workers.

Calves.—There were 39 calves as at the 1st January, and 51, consisting of 28 heifers and 23 bulls, were born during the year, making a total of 90. Of these 16 heifers, 11 bulls and 13 bullocks were transferred to the paddocks. Four calves (or 8%) were lost as a result of East Coast Fever as compared with 14 or 30% in 1944, leaving a balance of 46 calves at the end of the year. The reduction in the number of deaths from East Coast Fever is believed to be due to treating the sick animals with M & B 693 which although it has no specific effect on the parasites is thought to prevent secondary infection with pneumonia which in many cases, is believed to be the ultimate cause of death.

Milk Production.—A total of 4,800 gallons of milk were produced of which 2,591 gallons were sold, an increase of 25% over 1944. The remainder of the milk was fed to calves and pigs or was supplied free as rations to students. Small amounts were also made into ghee or butter. The best milker for the year was Akwazo with 1,985 lbs. (198 gals.) with calf at foot. Milk records show the following grouping:—

	No. of Cows.
Over 190 gallons in one lactation	1
Over 180 gallons in one lactation	1
Over 170 gallons in one lactation	3
Over 160 gallons in one lactation	2
Over 150 gallons in one lactation	3
Between 100 and 150 gallons in one lactation ..	14
Between 50 and 100 gallons in one lactation ..	13
Below 50 gallons in one lactation	8

FINANCIAL ASPECT OF CATTLE-KEEPING.

Valuation as at 1/1/45.		Valuation as at 31/12/45.	
	<i>Shs.</i>		<i>Shs.</i>
134 bulls and bullocks @ Shs. 60 ..	8,040	137 bulls and bullocks @ Shs. 100 ..	13,700
78 cows and heifers @ Shs. 50 ..	3,900	82 cows and heifers @ Shs. 100 ..	8,200
39 calves @ Shs. 10 ..	390	46 calves @ Shs. 30 ..	1,380
Appreciation	10,950		
TOTAL ..	<i>Shs. 23,280</i>	TOTAL ..	<i>Shs. 23,280</i>

PROFIT AND LOSS ACCOUNT, 1945.

<i>Dr.</i>	<i>Shs. cts.</i>		<i>Cr.</i>
			<i>Shs. cts.</i>
Labour and maintenance charges	4,500 00	Proceeds from sale of cows,	
Profit for the year	10,215 19	bulls and bullocks ..	2,177 35
		Proceeds from sales of milk	
		and milk products ..	1,464 05
		Proceeds from sale of hides ..	123 79
		Appreciation in valuation ..	10,950 00
TOTAL ..	<i>Shs. 14,715 19</i>	TOTAL ..	<i>Shs. 14,715 19</i>

The figures for valuation of stock although conservative clearly indicate the increased value of livestock over 1944.

The sale of produce does not include the value of milk, or meat, and milk products fed as rations to students and labourers.

In 1944 the cost of herdsmen, feeding, and veterinary requisites was estimated at Shs. 3,000. For 1945 the figure of Shs. 4,500 has been taken to cover the increased cost of wages, and stores.

Pigs.—Two Large-Black gilts and one boar were purchased in 1944. 10 piglets were born of which four died—cause of death unknown. At the end of June, 1946 there was a total of one boar, two sows and twelve piglets all of which are thriving. The pigs are fed a balanced ration made of foodstuffs produced on the farm and have access to unlimited grazing. No cassava is fed but sweet-potato tops are fed when available and are much relished. All food is now fed cooked as a mash and has resulted in better health and liveweight gains.

Small Stock.—Some sheep, goats and poultry were maintained for demonstration purposes for the benefit of the students. The number of goats and sheep is being considerably reduced following their unfortunate habit of damaging cotton plants by browsing. To keep goats successfully would require a three wire fence as against the normal two wires.

Miscellaneous

Grain Silo.—This was completed towards the end of 1945 and was filled with 40 tons of *Eleusine* grain, and sealed. It will be opened up for inspection in September, 1946.

Atapar (Pond).—This was considerably enlarged as a result of extensive brick making, all the bricks for the Civil Reabsorption Agricultural Centre being made on the farm. At all times it has held sufficient water for all the stock at Serere.

Labour.—The supply of labour at Serere continues to be most precarious and we have now reached the stage when no further work can be undertaken unless the supply of labour improves. At Serere there is no resident labour and we are entirely dependent on local cultivators who, naturally, when the weather conditions are most favourable and when we require them most, prefer to work on their own farms. June, July and August were particularly bad months in 1945 and the position deteriorated still further in 1946 largely as a result of competition from the Public Works Department. To maintain this station efficiently we require a minimum of 300 labourers but the average attendance is now well below 200. At times, especially while harvesting crops, it has been necessary to work double shifts but this is not satisfactory in that double pay has to be paid for a considerably reduced output of work, the men being tired and also because the men are reluctant to work overtime.

Buildings.—A slaughter-house, workshop, petrol store, and dairy-house were completed during the year.

E. WILLIAMS,
Agricultural Officer i/c, Serere.

APPENDIX I.

FERTILITY EXPERIMENT, 1945.

Cropping.

Cycle.	Circuit.	Year.	Cropping.	Plots.
I ..	Second ..	Fifth ..	All resting	90
II ..	Second ..	Fourth ..	Sorghum followed by cotton .. .	30
III ..	Second ..	Third ..	Groundnuts followed by sweet potatoes ..	60
IV ..	Second ..	Second ..	Eleusine followed by cotton. Manure applied to eleusine table .. .	90
V ..	Second ..	First ..	Cotton .. .	90

TABLE I—EFFECT OF MANURES.

Yields in pounds per Acre.

Manures.			Cycle V.	Cycle IV.		Cycle III.		Cycle II.	
			Cotton.	Eleusine.	Cotton.	Ground-nuts.	Sweet potatoes.	Sorghum.	Cotton.
M 1	..	..	580	1,379	116	1,166	2,358	1,787	126
M 2	..	..	575	1,395	141	1,329	3,426	1,819	149
M 3	..	..	541	1,480	165	1,436	3,498	1,879	161
Significance :									
Linear	..	..	None	None	1,000:1	100:1	1,000:1	None	20:1
Quadratic	..	..	None	None	None	None	20:1	None	None

M 1 = No Manure ; M 2 = 2½ tons ; M 3 = 5 tons Farmyard Manure per acre.

TABLE II—EFFECT OF COVER CROPS.

Yields in pounds per Acre.

Cover Crop.	Cycle V.	Cycle IV.		Cycle III.		Cycle II.	
		Eleusine.	Cotton.	Ground nuts.	Sweet potatoes.	Sorghum.	Cotton.
A	586	1,473	141	1,389	3,154	1,680	125
B	557	1,413	148	1,241	3,056	1,823	161
C	531	1,429	139	1,351	3,171	1,618	131
D	572	1,486	147	1,334	3,342	1,909	143
E	581	1,289	129	1,236	2,747	2,110	167
Significance :							
Grass v. green manure	None	None	None	None	None	None	None
Green manure (dug in)							
Green manure (slashed)	"	"	"	"	"	"	20:1
Planted grass v.							
Natural reopen ..	"	"	"	"	"	"	None
Planted grass grazed							
v. Not grazed ..	"	"	"	"	"	"	"

A=Natural Regeneration,
 B=Planted *Cynodon*,
 C=*Mucuna* slashed,
 D=Planted *Cynodon* grazed,
 E=*Mucuna* dug in.

TABLE III—EFFECT OF CROPPING RATIO.

Cropping Ratio.	Cycle V.		Cycle IV.		Cycle III.		Cycle II.	
	Cotton.	Eleusine.	Cotton.	Ground nuts.	Sweet potatoes.	Sor- ghum.	Cotton.	
4:1	608	1,204	142	1,360	3,111	1,828	145	
3:2	521	1,433	138	1,260	3,077	..	..	
2:3	567	1,531	143	..	..	..	..	
Significance :								
Linear	None	1000:1	None	None	None	..	..	
Quadratic	20:1	None	None	None	None	..	..	

4:1=Four years cropping and one year rest.
 3:2=Three years cropping and two years rest.
 2:3=Two years cropping and three years rest.

TABLE I—QUARTER-ACRE GRASS PLOTS, 1941.

Plot No. and Grass Species.	Ox Days per acre.					Yield of Cotton 1945/46 in lbs.	Notes.
	1941/42.	1942/43.	1943/44.	1944/45.	Total.		
79 <i>Chloris gayana</i> ..	192	232	200	368	992	740	Mixture of <i>Chloris</i> and <i>Imperata</i> . Closely grazed.
80 <i>Cynodon</i> ..	240	272	208	360	1,080	720	<i>Cynodon</i> and <i>Sporobolus</i> . Closely grazed.
81 <i>Brachiaria</i> ..	128	224	160	320	832	692	Dense <i>Brachiaria</i> bottom. Closely grazed.
82 <i>Pennisetum polystachum</i> ..	240	256	160	488	1,144	632	<i>Sporobolus</i> and <i>Imperata</i> .
83 <i>Setaria Sphacelata</i> (tufted type) ..	216	304	192	488	1,200	644	<i>Sporobolus</i> and <i>Imperata</i> with <i>Cynodon</i> bottom.
84 <i>Eragrostis superba</i> ..	152	336	224	656	1,368	604	Mostly <i>Eragrostis</i> .
85 <i>Panicum maz.</i> ..	192	264	184	344	984	652	Mixture of local grasses.
86 <i>Chloris gayana</i> and <i>Pennisetum Polystachum</i> ..	272	248	192	392	1,104	512	<i>Chloris</i> with some <i>Sporobolus</i> and some <i>Imperata</i> .
87 <i>Chloris gayana</i> and <i>Brachiaria</i>	232	240	208	400	1,080	444	Poor grazing—mostly <i>Sporobolus</i> .
88 <i>Chloris, Pennisetum polystachum, Rhynchelytrum repens</i> ..	296	296	208	368	1,168	452	<i>Chloris</i> and <i>Sporobolus</i> closely grazed.

Fertility Gradient



TABLE II—QUARTER-ACRE GRASS PLOTS, 1942.

Plot No. and Grass Species.	Ox days per acre.					Condition in June, 1946.
	1942/43.	1943/44.	1944/45.	1945/46.	Total.	
89 <i>Chloris gayana</i> and <i>Cynodon</i> ..	304	200	464	464	1,432	Planted to cotton May, 1946.
90 <i>Chloris</i> and <i>Brachiaria</i> (Ngetta) ..	192	272	456	544	1,464	
91 Dry Land Napier Grass ..	288	200	256	440	1,184	
92 <i>Cynodon</i> ..	264	240	480	456	1,440	
93 <i>Bothriochloa glabra</i> ..	184	224	472	424	1,304	
94 <i>Melinis minutifolia</i> ..	240	256	400	376	1,272	
95 <i>Brachiaria</i> (Ngetta) ..	248	258	432	512	1,450	
96 <i>Hyparrhenia rufa</i> ..	216	176	536	520	1,448	
97 <i>Cenchrus ciliaris</i> ..	272	232	440	416	1,360	
98 <i>Chloris gayana</i> ..	288	216	560	456	1,520	
99 <i>Setaria sphacelata</i> (free tillering strain)	168	240	496	424	1,328	
100 <i>Paspalum virgatum</i> ..	184	224	336	504	1,248	

TABLE III—QUARTER-ACRE GRASS PLOTS, 1943.

Plot No. and Grass Species.		1943/44.	1944/45.	1945/46.	Total.	Conditions in June, 1946.
101	<i>Melinis minutifolia</i>	96	512	440	1,048	Mostly <i>Melinis</i> with <i>Imperata</i> and <i>Sporobolus</i> coming in.
102	<i>Chloris Rhynchelytrum</i> and Dry Land Napier grass (<i>Pennisetum</i> sp.) ..	120	496	504	1,120	Mostly <i>Sporobolus</i> and <i>Cynodon</i> with some <i>Chloris</i> .
103	<i>Cenchrus ciliaris</i>	112	696	568	1,376	<i>Cenchrus</i> with <i>Sporobolus</i> and <i>Imperata</i> coming in.
104	<i>Hyparrhenia rufa</i>	160	536	464	1,160	<i>Hyparrhenia rufa</i> mixed with <i>Imperata</i> .
105	<i>Brachiaria</i> (Ngetta)	136	296	608	1,040	<i>Brachiaria</i> , <i>Imperata</i> and <i>Sporobolus</i> .
106	<i>Bothriochloa glabra</i>	64	336	528	928	Largely <i>Cynodon</i> and <i>Bothriochloa</i> .
107	<i>Chloris gayana</i>	136	344	464	944	Mixture of <i>Chloris</i> and <i>Imperata</i> with <i>Sporobolus</i> and <i>Hyparrhenia</i> coming in.
108	<i>Chloris Rhynchelytrum</i> and <i>Pennisetum</i> <i>Polystachum</i>	165	584	472	1,221	<i>Imperata</i> and <i>Sporobolus</i> .
109	<i>Setaria sphacelata</i> (free tillering strain) ..	72	440	400	912	<i>Sporobolus</i> with <i>Cynodon</i> bottom and small amounts of <i>Setaria</i> .
110	<i>Chloris</i> and <i>Brachiaria</i> (Ngetta) ..	96	392	472	960	<i>Sporobolus</i> predominant with some <i>Brachiaria</i> and <i>Chloris</i> .
111	<i>Cynodon</i> and <i>Brachiaria</i> (Ngetta) ..	48	632	496	1,176	<i>Sporobolus</i> predominant. Some <i>Brachiaria</i> and <i>Cynodon</i> .
112	<i>Cynodon</i>	144	840	552	1,536	<i>Sporobolus</i> with <i>Cynodon</i> bottom.

TABLE IV.—QUARTER-ACRE GRASS PLOTS, 1944.

Plot No. and Grass Species.	Ox days per acre.			Conditions in June, 1946.
	1944/45.	1945/46.	Total.	
113 <i>Bothriochloa glabra</i>	..	504	856	Mixture of <i>Bothriochloa</i> , <i>Sporobolus</i> and <i>Imperata</i> .
114 <i>Chloris gayana</i>	..	672	1,008	Mainly <i>Sporobolus</i> with little <i>Chloris</i> and <i>Cynodon</i> . Poor cover.
115 <i>Melinis minutifolia</i>	..	488	728	Mixture of <i>Melinis</i> , <i>Imperata</i> , <i>Cynodon</i> , <i>Panicum</i> and <i>Sporobolus</i> .
116 <i>Bothriochloa pertusaria</i>	..	520	792	<i>Bothriochloa</i> and <i>Cynodon</i> with <i>Imperata</i> and <i>Sporobolus</i> coming in.
117 <i>Leucena glauca</i> ..	..	616	776	<i>Cynodon</i> bottom with <i>Leucena</i> top. <i>Imperata</i> and <i>Sporobolus</i> coming in.
118 <i>Cenchrus ciliaris</i>	..	576	744	<i>Cenchrus</i> with some <i>Sporobolus</i> and <i>Imperata</i> .
119 <i>Hyparrhenia rufa</i>	..	616	944	Mostly <i>Cynodon</i> with some <i>Imperata</i> , <i>Hyparrhenia</i> and <i>Sporobolus</i> .
120 Pigeon Peas	..	360	496	Predominantly <i>Cynodon</i> with some <i>Sporobolus</i> . No pigeon peas.
121 <i>Chloris</i> and <i>Leucena</i>	..	384	592	<i>Sporobolus</i> , <i>Cynodon</i> with small amounts of <i>Leucena</i> .
122 <i>Cynodon</i>	..	352	456	<i>Sporobolus</i> with <i>Cynodon</i> bottom, very weedy.
123 <i>Chloris</i> , <i>Rhynchelytrum</i> and <i>Pennisetum polystachyum</i>	..	424	752	<i>Sporobolus</i> and <i>Paspalum commersonii</i> . Little <i>Chloris</i> .
124 <i>Chloris</i> and <i>Mucuna</i>	..	416	624	Predominantly <i>Sporobolus</i> with <i>Panicum</i> coming in and some <i>Chloris</i> .